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Ensayos en finanzas internacionales

Essays in international finance

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PRESENTADA POR

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A Ana, a mis padres y mi hermano.

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Summary

Essays in International Finance

This thesis consist of three papers, all of them analyzing empirically the role of the exchange rates on different dimensions of the international finance literature. The first two papers are closely related to each other and study how different exchange rate regimes affect the external adjustment process of a country. The first one, *Exchange Rate Regime and External Adjustment: An Empirical Investigation for the U.S*, analyzes the consequences of the end of the Bretton Woods system of fixed exchange rates for the U.S. and the second one, *External Adjustment with a Common Currency: The Case of the Euro Area*, analyzes the effects of the introduction of the euro for the four main economies within the euro area. The third paper, *Forecasting Emerging Market Currencies: Are Inflation Expectations Useful?*, studies the forecasting power that inflation expectations have over the foreign exchange for a group of emerging market economies.

The role of the nominal exchange rate regime in the process of external adjustment has been a topic of ample research in the international finance literature. During the Bretton Woods system of fixed exchange rates, Friedman (1953) warned that flexible exchange rates facilitate the correction of external imbalances by allowing an automatic adjustment in a context of nominal rigidities. Empirical research on this topic has just focused on whether the exchange rate regime affects the flexibility of the current account, without taking into account the adjustment of the total stock of net foreign asset. The first two papers of this thesis try to fill this gap by analyzing the consequences of different nominal exchange rate regimes on the external adjustment of the net foreign asset position for the U.S. and the four main economies of the euro area. The process of external adjustment and the reduction of global imbalances remain crucial for two reasons. First, economies with large net liability positions are more vulnerable to capital markets disruptions, compromising their access to external financing during periods of financial stress. Second, growing imbalances may end up in sustainability problems as it was the case in the global financial crisis and during the subsequent euro area crisis, when several economies experienced sudden stops, sovereign debt problems or both.

I use as a starting point for the empirical analysis a present value equation that relates current external imbalances with future expected net exports growth (trade component) and portfolio return differentials between assets and liabilities

(valuation component). Because the exchange rate has the dual role of affecting the differential in rates of return between assets and liabilities denominated in different currencies and also of affecting future net exports, changes in the nominal foreign exchange rate regime may affect the external adjustment process. For the case of the U.S. I find a structural break in the net external position at the end of the Bretton Woods system of fixed exchange rates that changed both the mean and variance of the series. On average, the U.S. changed from a creditor to a debtor position and the variance of the external position increased during the floating period. This increase is to a large extent due to the valuation component of external adjustment, which accounts for 54% of the variance of the U.S. external position during the floating period but only 29% during the fixed exchange rate period. Further analysis shows that the exchange rate regime mainly affects the valuation channel of external adjustment. I do also document asset pricing implications from the relationship between the exchange rate regime and the external adjustment process of the U.S., as external imbalances predict the future path of the dollar once the exchange rate regime is taken into account.

In the second paper I do find a structural break in the behavior of the net external position for France, Italy and Spain at the time of the introduction of the euro, pointing out that the inception of the common currency changed the external adjustment process of these countries. Germany does not show this structural break, being its external position more affected by other events such as the country reunification in 1989. I also find that France and Italy will adjust the net external position mainly through the valuation component, while Germany and Spain will restore their external balance mostly through the trade component. The common currency area exacerbated Germany's net creditor position as the evolution of the euro has reacted to the external adjustment needs of debtor countries such as Italy and Spain.

The results of these two papers continue the debate for policy analysis on the benefits of a fixed or a floating exchange rate regime to correct external imbalances. The findings in these papers do reveal the prominent role of the exchange rate in the external adjustment process and the need of other adjustment mechanisms once a common currency is in place, such as internal devaluation and the change in the relative price levels. It is also important to notice that being part of a currency union may hinder the external adjustment of a country as the needs are different for debtor and creditor countries.

In the third paper we use an expectation version of purchasing power parity (EVRPPP) based on the differential of inflation expectations for Brazil, Colombia,

Chile, India, Mexico, Poland, South Africa, South Korea and Turkey. Using monthly data on exchange rates and on the inflation expectations, we find that our predictors are not significantly better than the random walk model, with the exception of the Chilean peso. On the other hand, they outperform the random walk when considering the sign of the rate of change in all cases but the South Korean won. Adding a risk premium to forecast the exchange rate makes the predictors to outperform the random walk for the case of the South African Rand and the Turkish lira. We also find strongly support for Granger causality running from exchange rate to the forecasts based on EVRPPP and only partial evidence of Granger causality running the other way around.

Resumen

Ensayos en Finanzas Internacionales

Esta tesis contiene tres capítulos, todos ellos relacionados sobre el papel que el tipo de cambio tiene en diferentes dimensiones de las finanzas internacionales. Los dos primeros capítulos están muy relacionados y analizan como el régimen de tipo de cambio afecta al proceso de ajuste externo de los países. El primer capítulo, *Régimen de tipo de cambio y ajuste externo: Una investigación empírica para los EE.UU.*, analiza las consecuencias del final del sistema de Bretton Woods de tipos de cambio fijos para los EE.UU., y el segundo capítulo, *Ajuste Externo en una unión monetaria: El caso de la zona del euro*, estudia los efectos de la introducción del euro sobre las cuatro principales economías de la zona del euro. El tercer capítulo, *Predicción del tipo de cambio en mercados emergentes: ¿Son las expectativas de inflación útiles?*, que es autocontenido, analiza el poder de predicción que las expectativas de inflación tienen sobre el tipo de cambio para un grupo de economías emergentes.

El papel del régimen de tipo de cambio en el proceso de ajuste externo ha sido un tema de análisis muy debatido en la literatura. Durante el sistema de Bretton Woods de tipos de cambio fijos, Friedman (1953) advirtió que los tipos de cambio flexibles facilitaban la corrección de los desequilibrios externos permitiendo un ajuste automático en un contexto de rigideces nominales. La investigación empírica sobre este supuesto se ha centrado en estudiar si el régimen de tipo de cambio afecta al ajuste de la cuenta corriente, sin tener en cuenta el análisis sobre el stock total neto de activos externos. Los dos primeros capítulos de esta tesis tratan de cubrir este vacío analizando las consecuencias del régimen de tipo de cambio sobre el ajuste en la posición financiera internacional neta de los EE.UU. y de las cuatro principales economías dentro del área del euro. El proceso de ajuste externo y la reducción de los desequilibrios globales siguen siendo temas relevantes por dos razones principales. En primer lugar, las economías con posiciones deudoras netas muy elevadas son más vulnerables a las disrupciones en los mercados de capitales, comprometiendo su acceso a la financiación exterior durante periodos de estrés financiero. En segundo lugar, el aumento de los desequilibrios externos puede producir problemas de sostenibilidad, algo que se hizo evidente durante la crisis financiera global y la posterior crisis del área del euro, en las que varias economías experimentaron interrupciones bruscas en los flujos de capitales y problemas de deuda soberana.

Para desarrollar el análisis empírico se parte de una ecuación de valor presente que relaciona el desequilibrio externo actual de un país con la evolución futura esperada en el crecimiento de las exportaciones netas (componente de comercio) y el diferencial en el rendimiento de activos y pasivos externos (componente de valoración). Debido a que el tipo de cambio tiene el papel dual al afectar el diferencial del rendimiento de activos y pasivos denominados en monedas distintas y también de influir en la evolución futura de las exportaciones netas, los cambios en el régimen del tipo de cambio pueden condicionar el proceso de ajuste externo. En el caso de los EE.UU. se documenta una ruptura estructural en el comportamiento de la posición exterior neta al final del sistema de tipos de cambio fijos de Bretton Woods, que cambió tanto la media como la varianza de la serie. Los EE.UU. pasaron de mantener una posición acreedora a una deudora y la varianza de la posición externa neta aumentó durante el periodo de tipo de cambio flexible. Este incremento fue debido principalmente al comportamiento del componente de valoración, que fue capaz de explicar el 54 % de la varianza de la posición externa neta de los EE.UU. durante el periodo de tipo de interés flexible y tan sólo el 29 % de la misma durante el periodo de tipo de cambio fijo. Además, la posición exterior neta de EE.UU. tiene poder predictivo sobre la evolución futura del dólar una vez se ha tenido en cuenta el régimen de tipo de cambio.

En el segundo capítulo se documenta una ruptura estructural en el comportamiento de la posición externa neta de Francia, Italia y España en el momento de la introducción del euro, apuntando a que la creación de la moneda única cambió el proceso de ajuste externo en estos países. Alemania sin embargo no experimentó esta ruptura estructural y su posición externa se ha visto más afectada por otros eventos como la reunificación del país en 1989. Los resultados empíricos muestran que Francia e Italia ajustarán sus desequilibrios externos principalmente por medio del componente de valoración, mientras que en Alemania y España primará el componente de comercio.

Los resultados de estos dos primeros capítulos mantienen el debate sobre los beneficios entre un régimen de tipo de cambio fijo o flexible a la hora de corregir los desequilibrios externos. Estos resultados muestran el papel relevante que el tipo de cambio tiene en el proceso de ajuste externo, y la necesidad de otros mecanismos de corrección una vez que el tipo de cambio es fijo. También conviene destacar que la pertenencia a una unión monetaria puede dificultar el proceso de ajuste externo ya que las necesidades de ajuste son diferentes para un país deudor o acreedor.

En el tercer capítulo se parte una versión con expectativas de la paridad de poder de compra (EVRPPP), utilizando el diferencial sobre expectativas de inflación para Brasil, Colombia, India, México, Polonia,. Sudáfrica, Corea del Sur y Turquía. Utilizando datos mensuales de tipos de cambio frente al dólar y expectativas de inflación, se observa cómo, salvo en el caso del peso chileno, los predictores obtenidos no mejoran al paseo aleatorio. Por otro lado, estos predictores superan al paseo aleatorio cuando se considera la capacidad predictiva sobre el signo en la variación del tipo de cambio. Se documenta además causalidad en el sentido de Granger del tipo de cambio sobre los predictores basados en EVRPPP y sólo evidencia parcial de causalidad de Granger en el otro sentido.

Chapter 1

Introduction

The role of the nominal exchange rate regime in the process of external adjustment has been a topic of ample research. During the Bretton Woods system of fixed exchange rates, Friedman (1953) warned that flexible exchange rates facilitate the correction of external imbalances by allowing an automatic adjustment in a context of nominal rigidities. Empirical research on this topic has just focused on whether the exchange rate regime affects the flexibility of the current account, narrowing the analysis to the trade component of external adjustment and neglecting the importance of the already documented valuation channel.

The first two papers included in this thesis try to fill this gap by analyzing how the nominal exchange rate regime affect the adjustment of the total stock of net debt in the case of two different areas. First, I study how the end of the Bretton Woods system of fixed exchange rates affected the behavior of the net external position of the U.S. Complementing this analysis, the second paper studies how the introduction of the euro have changed the external adjustment process of the main economies within the euro area. The analysis of these two different events is crucial because it may provide empirical evidence on the effects of a change in the nominal exchange rate regime under opposite scenarios. In the case of the U.S. there is a change from a fully fixed exchange rate regime to a floating one, and in the case of the euro area there is a new exchange rate regime with fixed rates among the countries of the currency union. Despite the fact of being different processes it should be the case that the behavior of the net external position changes under both of them if the nominal exchange rate regime plays a role in the external adjustment.

The main goal of this thesis is to document that the net external position of a country changes its behavior under different nominal exchange rate regimes. A secondary task is to analyze how this external adjustment process is different under two nominal exchange rate regimes.

Several studies have empirically investigated the hypothesis raised by Friedman analyzing if the behavior of the current account is affected by the exchange rate regime, obtaining different results. Chinn and Wei (2013) find no relationship between the flexibility of foreign exchange regimes and the rate of current account reversion. On the other hand, Gosh et al. (2014) argue that previous studies fail to find such a relationship due to the exchange rate regime classification used. They do find a robust relationship between the exchange rate regime and the speed of external adjustment confirming Friedman's hypothesis by using a novel data set of bilateral foreign exchange regimes. Similarly, Eguren-Martin (2016) finds robust evidence that flexible exchange rate arrangements deliver a faster current account adjustment among non-industrial countries.

Friedman's argument as well as the studies supporting his hypothesis focus on the trade balance as the mechanism through which exchange rates operate to reduce external imbalances. For instance, Gosh et al. (2014) use bilateral data on trade balances as their measure of external imbalance and Eguren-Martin (2016) finds that the most robust driver in the correction of current account imbalances is expenditure switching between local and foreign products as relative prices change, particularly via its impact on exports.

As this thesis aims to analyze the effects of the nominal exchange rate regime on the total stock of net debt and not only in a flow variable such as the current account, other adjustment mechanisms should be taken into account. For instance, Gourinchas and Rey (2007) show that the dynamics of the exchange rate play a major role in the external adjustment process of the U.S. since it has the dual role of changing the differential in rates of return between assets and liabilities denominated in different currencies (valuation component) and also of affecting future net exports (trade component). Lane and Shambaugh (2010) do also emphasize the impact of currency movements on the external positions for a large sample of countries. They find that the wealth effects associated with exchange rate changes are substantial and can explain a sizeable share of the overall valuation shocks that hit the net foreign asset position.

Theoretical models have also emphasized the role of valuation effects on the dynamics of the net external position. Devereux and Sutherland (2010) present a DSGE model with portfolio choice capable to reproduce the dynamics of the valuation channel of external adjustment. The model can only generate unexpected valuation effects, being the anticipated ones small and reproduced at higher orders of approximation. Ghironi et al. (2015) also examine the valuation channel of external adjustment theoretically in a DSGE model, being able to separate asset prices and quantities in the definition of net foreign assets. This is more consistent with previous empirical work that has documented the relevance of expected valuation effects (see Gourinchas and Rey (2007)).

In the two first papers of the thesis I also document how the external adjustment process have changed due to different nominal exchange rate regimes by analyzing the behavior of the valuation and the trade components and the contribution of the exchange rate to these two components.

Understanding the mechanisms behind the external adjustment process results crucial as economies with large net liability positions are more vulnerable to capital markets disruptions, compromising their access to external financing during periods of financial stress. Also, growing imbalances may end up in sustainability problems as both public and private debt overcomes the size of the economy. These vulnerabilities played a prominent role both in the global financial crisis and during the subsequent euro area crisis, as several economies experienced sudden stops, sovereign debt problems, or both.

The introduction of the euro made the effects of nominal exchange rate changes to disappear among the countries in the currency area. First, a net debtor country could not rely anymore on foreign exchange depreciations to reduce the relative value of the local currency external debt held with the countries in the currency union. Similarly, a currency depreciation will not have any direct impact on the bilateral trade among the countries with the same currency. Second, the behaviour of the exchange rate may not favor the external adjustment of all countries in the currency area, as foreign exchange movements will respond to the macroeconomic and monetary conditions of the whole currency union. For instance, a debtor country within the union that would benefit from an exchange rate depreciation to improve its external position may face an appreciating currency due to the macroeconomic situation of the other countries and the current monetary policy of the central bank. Because of these two reasons, changing from a floating to a fixed exchange rate regime within a common currency area may difficult the external adjustment and could be potentially dangerous for countries with large negative external positions.

The lack of nominal exchange rate adjustment for the bilateral transactions and external positions among the countries of the currency area may difficult the reduction of large net external liability positions. As an alternative, the more complicate and slower process of adjustment in product prices and wages (internal devaluation) may operate in the absence of the nominal foreign exchange.

In the first two papers, I do also analyze if the net external position has any forecasting power over the foreign exchange, once we take into account the nominal exchange rate regime. I do find that the net external position predicts the future evolution of the foreign exchange for different horizons. This is, by itself, an important result given the scarce literature on variables capable to forecast the foreign exchange. The forecasting power increases with the horizon of the exchange rate and it also increases once I introduce the variables with the information about the different exchange rate regimes. In fact, for the case of the U.S., the net external position does not have any forecasting power over the foreign exchange if the nominal exchange rate regime is not taken into account.

The thesis ends with another exercise trying to forecast the foreign exchange, in this case using inflation expectations. The last paper builds on previous work done by Sosvilla-Rivero and García (2005), in which they use an Expectations Version of Relative Purchasing Power Parity (EVRPPP) to generate expected short-run variations in the dollar/euro exchange rate. With few exceptions, their predictors, based on the differential of inflation expectations derived from inflation-indexed bonds for the euro area and the USA, behave significantly better than a random walk. Since the influential paper by Meese and Rogoff (1983) on the poor predictive capacity of exchange rate determination models compared to a random walk, there has been an immense amount of effort dedicated to analysing the causes of the extreme difficulties experienced when attempting to predict exchange rates, as well as attempts to design alternative procedures that offer improvements in predictions.

We test if the EVRPPP is also useful to predict the future evolution of exchange rates for emerging market currencies. In this case, we apply the methodology implemented by Fuertes et al. (2018) to obtain inflation expectations, due to the difficulties to extract them from financial instruments in those markets. Finally, we also test if the uncovered rate parity condition could be useful in predicting the foreign exchange.

Chapter 2

Exchange Rate Regime and External Adjustment: An Empirical Investigation for the U.S.

A paper based on this chapter has been published as- Fuertes, A. (2019). Exchange Rate Regime and External Adjustment: An Empirical Investigation for the U.S. *The World Economy*, Vol 42, Issue 5, pp 1373-1399.

2.1 Introduction

The role of the nominal exchange rate regime in the process of external adjustment has been a topic of ample research. During the Bretton Woods system of fixed exchange rates, Friedman (1953) warned that flexible exchange rates facilitate the correction of external imbalances by allowing an automatic adjustment in a context of nominal rigidities. Empirical research on this topic has just focused on whether the exchange rate regime affects the flexibility of the current account, narrowing the analysis to the trade component of external adjustment and neglecting the importance of the already documented valuation channel. This work tries to fill this gap by analyzing the consequences of different nominal exchange rate regimes on the external adjustment of the U.S. net foreign asset position.

The process of external adjustment and the reduction of global imbalances remain crucial for two reasons. First, economies with large net liability positions are more vulnerable to capital markets disruptions, compromising their access to external financing during periods of financial stress. Second, growing imbalances may end up in sustainability problems as both public and private debt overcomes the size of the economy. These vulnerabilities played a prominent role both in the global financial crisis and during the subsequent euro area crisis, as several economies experienced sudden stops, sovereign debt problems, or both. Understanding the different mechanisms through which external imbalances can be corrected may help to avoid excessive unbalanced positions. The real exchange rate plays and important role as one of these mechanisms and the nominal exchange rate regime should play it as well. There is a documented relationship between the real exchange rate and the foreign exchange regime (see for example Morales-Zumaquero and Sosvilla-Rivero (2010)), with the real exchange rate being less volatile under fixed exchange rate regimes. Because of that, floating regimes may induce larger imbalances and faster corrections. Also, changing from a floating to a fixed exchange rate regime may difficult the external adjustment and could be potentially dangerous for countries with large negative external positions. To the best of my knowledge, this is the first study that analyzes whether the nominal exchange rate affects the adjustment of the net foreign asset position.

The trade channel of external adjustment assumes that countries running current accounts deficits would reduce their imbalances by exchange rate depreciation, boosting exports and reducing imports. Several studies have empirically investigated how this trade channel is affected by the exchange rate regime with different results. Chinn and Wei (2013) find no relationship between the flexibility of foreign exchange regimes and the rate of current account reversion. On the other hand, Gosh et al. (2014) argue that previous studies fail to find such a relationship due to the exchange rate regime classification used. They do find a robust relationship between the exchange rate regime and the speed of external adjustment confirming Friedman's hypothesis by using a novel data set of bilateral foreign exchange regimes. Similarly, Eguren-Martin (2016) finds robust evidence that flexible exchange rate arrangements deliver a faster current account adjustment among non-industrial countries.

Friedman's argument as well as the studies supporting his hypothesis focus on the trade balance as the mechanism through which exchange rates operate to reduce external imbalances. For instance, Gosh et al. (2014) use bilateral data on trade balances as their measure of external imbalance and Eguren-Martin (2016) finds that the most robust driver in the correction of current account imbalances is expenditure switching between local and foreign products as relative prices change, particularly via its impact on exports. Against these findings, the literature on the exchange rate disconnect provides increasing evidence of a possible weakened relationship between exchange rates and trade, being the rise of global value chains a common explanation (IMF (2015a), Swarnali et al (2016) and Patrice et al (2015)).

A recent wave of empirical studies has pointed out the importance of valuation effects in the adjustment of external imbalances, being the real exchange rate a mayor player. Gourinchas and Rey (2007) show that the dynamics of the exchange rate play a major role since it has the dual role of changing the differential in rates of return between assets and liabilities denominated in different currencies and also of affecting future net exports. They also point out that because the current account is reported at historical cost it may be a very approximate and potentially misleading reflection of the change of a country's net foreign asset position. Using a data set on U.S. gross external positions and portfolio returns they find that the valuation component has contributed by 27% to the cyclical external adjustment. Further analysis by Evans and Fuertes (2011) and Evans (2012) show that the contribution of the valuation component is larger than that of the trade component when analyzing the adjustment of the whole U.S. net foreign asset position and not only its cyclical part[1]. None of these papers analyze the implications of different exchange rate regimes for the external adjustment process.

The relevance of the valuation component makes necessary to incorporate its contribution when analyzing the relation between the exchange rate regime and the external adjustment. Moreover, the documented weakened relationship between exchange rates and trade may leave valuation effects as the main factor in the external adjustment process. The ignored valuation component may act reinforcing the trade channel of external adjustment or against it, depending on the currency composition of foreign assets and liabilities. For instance, a debtor country with most of its external liabilities denominated in foreign currency could potentially experience valuation effects that more than offset the improvement on its external position coming from an exchange rate depreciation due to the traditional trade channel. This is very unlikely in the case of developed countries, such as the U.S., where most of its debt is denominated in domestic currency, but it could be possible for emerging economies that accumulate a large part of

[1]Evans and Fuertes (2011) and Evans (2012) analyze the adjustment of the U.S. external imbalance since 1973, covering only the floating exchange rate regime period. Gourinchas and Rey (2007) analyze this adjustment during the fixed and the floating exchange rate regimes focusing only on the cyclical component of the U.S. external imbalance.

its debt in foreign currency.[2] In any case, ignoring the importance of valuation effects may distort the exchange rate contribution to the external adjustment.

Within this framework, the contribution of this paper is threefold. First, I document a robust relationship between the foreign exchange regime and the external adjustment process, identifying a structural break in the mean and the variance of the U.S. external position at the end of the Bretton Woods system of fixed exchange rates in 1973. The variance of the U.S. external position increased and its mean changed from a creditor to a debtor position during the floating exchange rate period that began in 1973. Second, the valuation component increased its contribution to the variance of the U.S. external position from 29% during the fixed exchange rate regime to 54% over the floating period, with the part of the valuation component related to the real exchange rate accounting for 19% of that variance. Further analysis shows that the exchange rate regime mainly affects the valuation channel of external adjustment. There is also evidence of another structural break in the U.S. net external position around the time of the introduction of the euro. Third, I document asset pricing implications from the relationship between the exchange rate regime and the external adjustment process, as external imbalances predict the foreign exchange once the exchange rate regime is taken into account. Furthermore, the relationship between the external imbalance and future changes of the real exchange rate is affected by the nominal exchange rate regime.

Following Evans and Fuertes (2011) and Evans (2012), I use a simple present value equation that relates current external imbalances with future expected net exports growth and portfolio return differentials.[3] Applying the methodology developed by Campbell and Shiller (1988) to this present value equation, I analyze a VAR specification that includes the three main variables of study (the external imbalance, net exports growth and portfolio return differentials), documenting a change on the behavior of the U.S. external position that happened when the Bretton Woods system of fixed exchange rates collapsed in 1973. I also document this change by applying the methods developed by Qu and Perron (2007) to test for structural breaks in mean and variance at unknown dates in a system of equations. I do find a structural break in the VAR specification at the end of Bretton Woods system of fixed exchange rates. The test reveals not only a change

[2] Calvo and Reinhart (2002) point out to liability dollarization as one of the reasons for the "fear of floating" in emerging economies.

[3] This present value equation includes both the cyclical and the secular components of the external imbalance while the equation developed by Gourinchas and Rey (2007) only includes the cyclical component.

in the variance of the series but also a change in the mean, suggesting that the large deterioration of the U.S. net external position could be related, at least to some extent, to the end of the fixed exchange rate regime. I also find evidence of another break that happened right before the introduction of the euro, signaling that this currency union may have affected the U.S. external adjustment path. This finding should not be surprising as the U.S. has an important part of its foreign assets denominated in euros. The test identifies a third break in 1984, the beginning of the period known as the Great Moderation.[4]

I also apply the method proposed by Inclan and Tiao (1994) to detect changes in the unconditional variance of a series, which provides robustness to the previous result. I find three structural breaks in the variance of the U.S. external position at the same points in time of those previously identified in the VAR specification. For the series of portfolio returns differentials, this test identifies two breaks, one at the end of Bretton Woods and another at the end of the 1990's. For the series of net exports growth there is only one structural break in the variance at the beginning of 1984. This may be consistent with the nominal exchange rate regime mainly operating through the valuation channel. On the contrary, the trade channel seems to be more related to the real economy, with the break in that series happening at the beginning of the Great Moderation. Additionally, I apply tests of structural breaks in mean at unknown dates developed by Bai and Perron (1998) to the U.S. external position, identifying breaks at the same points in time than those previously documented using the VAR specification. The series of portfolio return differentials and net exports growth do not present any structural break in mean.

The paper proceeds as follows: Section 2.2 presents the proposed measure of external imbalances. Section 2.3 describes the data used and Section 2.4 analyzes the behavior of the U.S. net external position under different exchange rate regimes. Section 2.5 presents the tests of structural breaks and Section 2.6 analyzes the asset pricing implications. Section 2.7 concludes.

2.2 Net External Position

The current account measures transactions in goods, services, income, and net unilateral current transfers between residents and nonresidents during the year. For the purpose of analyzing the relation between the external adjustment and the exchange rate regime, this measure may present several problems. First, it

[4]See McConnell and Perez-Quiros (2000).

may not accurately portrait the needs of external adjustment of a country as it does not take into account the stock of total debt. Second, it does not include the effects of changes in asset prices and exchange rate movements on a country's external imbalance. In the case of the U.S., this is quite obvious if we compare the cumulative value of current account deficits with the International Investment Position as it is shown in Figure 2.1. The former is less negative due to the valuation effects related with changes in the price of assets and exchange rate movements. Focusing only on current account imbalances we may conclude that the need for external adjustment in the U.S. is much larger than it really is as valuation effects have mitigated, in part, the deterioration of the U.S. external position. Thus, if we want to investigate the effects of the nominal exchange rate regime on the process of external adjustment it looks reasonable to incorporate a measure based on the Net International Investment Position (NIIP), which is directly affected by exchange rate movements.

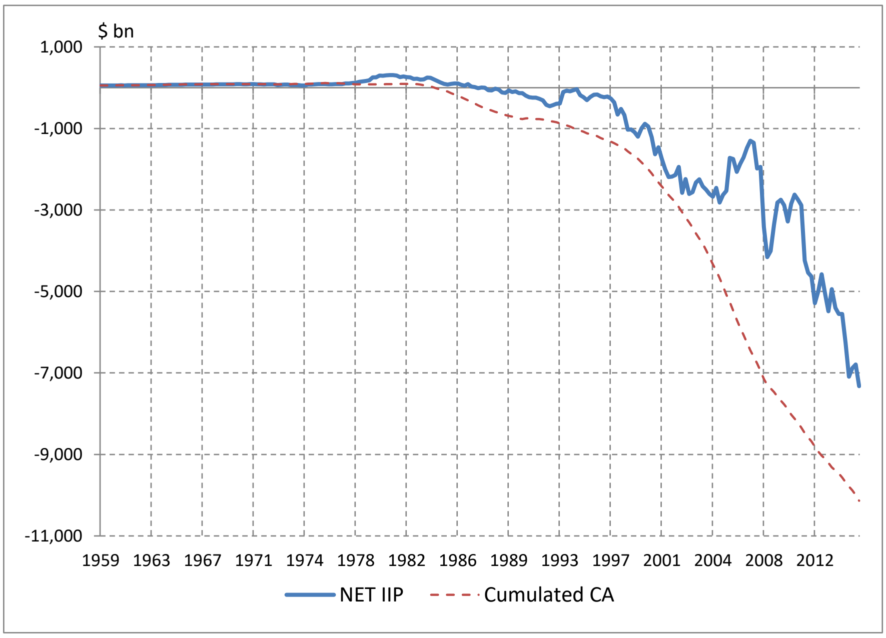

Figure 2.1: U.S. Net International Iinvestment Position vs. Cummulated Current Account

Gourinchas and Rey (2007) derive a present value equation that relates the cyclical component of a country's net external position with future net exports growth and portfolio return differentials. Evans and Fuertes (2011) develop a similar present value relation including both the cyclical and secular components of the country's net external position[5]. I follow this approach and use their measure of external imbalance as the variable of interest to analyze the consequences of different nominal exchange rate regimes on the process of external adjustment. Both Gourinchas and Rey (2007) and Evans and Fuertes (2011) find that a relevant part of the changes in the U.S. net external position come from the valuation channel. They also find that the net external position predicts future exchange rate movements over periods beginning in 1973. As I already mentioned, none of these papers study the implications of the exchange rate regime for the external adjustment process.

Evans and Fuertes (2011) derive the present value relation for the net external position using several log-linearizations that include assumptions about the behavior of different financial ratios[6]. I will next summarize the main steps to obtain this present value equation.

I start with the following equation:[7]

$$FA_t - FL_t \equiv X_t - M_t + R_t^{FA} FA_{t-1} - R_t^{FL} FL_{t-1} \tag{2.1}$$

Where FA_t and FL_t are gross foreign assets and liabilities at the end of period t, X_t and M_t are exports and imports during period t, all measured in terms of the consumption index. R_t^{FA} and R_t^{FL} represent gross real returns on foreign assets and liabilities between the end of periods $t-1$ and t. After several log-linearizations and some algebra I obtain the following relation:

$$nfa_t \approx r_t^{NFA} + \frac{1-\rho}{\rho} nx_{t-1} + \frac{1}{\rho} nfa_{t-1} \tag{2.2}$$

Where nfa_t is the log of the ratio of foreign assets to liabilities at the beginning of period t. r_t^{NFA} is the log of the return differential of foreign assets and liabilities and nx_t is the difference of the log of exports minus imports. ρ is a discount factor. Defining $nxa_t = nfa_t + nx_t$ and $\Delta nx_t = nx_t - nx_{t-1}$ I obtain the following expression:

$$nxa_t \approx r_t^{NFA} + \Delta nx_t + \frac{1}{\rho} nxa_{t-1} \tag{2.3}$$

Iterating forward equation (2.3) and taking expectations conditioned on period t

[5] A similar methodology was also applied by Evans (2012).

[6] See Evans and Fuertes (2011) and the Appendix for a complete description of the derivations.

[7] The analysis does not include the secondary income which has been historically low for the U.S.

information, which includes de value of nxa_t , I obtain:

$$nxa_t \approx -E_t \sum_{i=1}^{\infty} \rho^i (r_{t+i}^{NFA} + \Delta nx_{t+i}) + E_t \lim_{i \to \infty} \rho^i (nxa_{t+i})$$

I impose the no-Ponzi game condition $E_t \lim_{i\to\infty} \rho^i (nxa_{t+i}) = 0$ on the equation above. I will further develop the implications of this condition in the next sections but the intuition is that a country cannot default on its foreign claims. For the case of the U.S. it seems to be a reasonable assumption, especially if we assume that agents follow rational expectations. The next equation shows the present value relation between the variable nxa_t and future expected portfolio return differentials and net exports growth,[8]

$$nxa_t \approx -E_t \sum_{i=1}^{\infty} \rho^i (r_{t+i}^{NFA} + \Delta nx_{t+i}) \tag{2.4}$$

I will use nxa_t as the variable of interest that measures external imbalances, being the two terms at the right hand side of the equation the valuation component and the trade component respectively. This equation shows how current imbalances will be corrected in the future. Equation (2.4) implies that the net external position can only vary if it forecasts changes in portfolio returns or if it forecasts changes in net exports growth. If $E_t \sum_{i=1}^{\infty} \rho^i r_{t+i}^{NFA} = 0$, any adjustment of the net external position will come from future changes in net exports growth (trade component). On the other hand, if $E_t \sum_{i=1}^{\infty} \rho^i \Delta nx_{t+i} = 0$, any adjustment will come from future changes in portfolio returns (valuation component).

Regarding the main research question, if the nominal exchange rate regime affects the behavior either of the valuation component or the trade component, then the external adjustment process should be affected.[9] Movements in the real exchange rate affect the valuation component because it modifies the yield of gross foreign assets and liabilities as well as capital gains, affecting the portfolio total return differential. The trade component could be also affected as there is a documented relationship between real exchange rate depreciation and improvements in the trade balance [IMF (2015b)].[10]

[8] In deriving equation (2.4) I have performed several first order approximations. To assess the accuracy of those approximations we can compute the error term from equation (2.3) which also includes any measurement errors from the original data. The error term is small and stationary, with its sample variance representing only 0.12% of the sample variance of nxa_t.

[9] In principle, as long as the nominal exchange rate regime changes the behavior of the real exchange rate, e.g. Morales-Zumaquero and Sosvilla-Rivero (2010), the external adjustment process could change as well.

[10] In particular it is pointed out that a 10 percent real effective depreciation in an economy's

In order to empirically analyze how the exchange rate regime affects the behavior of the net external position and the external adjustment process, I estimate the valuation and the trade components from equation (2.4) following methods developed by Campbell and Shiller (1987). This estimation will allow me to check if there is any misspecification in the estimation such as non-linearities or structural breaks, as these two components should account for all the variation in the net external position. It also let us quantifying the contribution of each component to the adjustment of the U.S. net external position. The period of analysis covers both the Bretton Woods fixed exchange rate regime and the years after its collapse, from 1952:I to 2015:III.

2.3 Data

The empirical analysis uses quarterly data on U.S. gross foreign assets and liabilities positions as well as portfolio returns for the categories of equity, debt, FDI and other assets. It extends the data constructed by Gourinchas and Rey (2007) till 2015:III. The data on gross positions comes from the NIIP from the Bureau of Economic Analysis (BEA, henceforth). They estimate quarterly positions for each category using BEA end of year positions, quarterly flows from the Federal Reserve Flow of Funds Accounts and valuation adjustments calculated using capital gains. Total returns and capital gains are obtained using the broadest stock market indices available in each country for the equity and FDI categories; and using short-term and long-term interest rates for the fixed income category. See Gourinchas and Rey (2005) for a detailed description of the series and the methodology used to compute them. Data on exports and imports comes from the National Income and Product Accounts Tables from the BEA and price index data[11] comes from the BEA as well.

Regarding the data expansion it is relevant to mention that NIIP series obtained from the BEA provides quarterly data on the U.S. NIIP since 2006. This makes the extended data more accurate as the quarterly data on NIIP previous to 2006 had to be estimated from the annual figures using quarterly flows and calculating capital gains. Another improvement comes from the calculations made to obtain portfolio returns. Equity returns are calculated using country

currency is associated with a rise in real net exports of, on average, 1.5 percent of GDP, with substantial cross-country variation around this average. Although these effects fully materialize over a number of years, much of the adjustment occurs in the first year. See IMF (2015b). This relationship between exchange rates and trade may have weakened over time (see IMF (2015a)).

[11]It is used a personal consumption expenditures price index.

weights from the Report on U.S. Portfolio Holdings of Foreign Securities released by the Department of the Treasury. The report is released on an annual basis since 2003 and the weights are updated every year instead of keeping them constant over several years. The returns are calculated as portfolio weighted averages for each individual series and they are computed from market prices.

Table 2.1: Return differentials comparison (%)

Source	Period	Difference	Claims	Liabilities	Type of data
		0.14	**7.47**	**7.33**	
Gourinchas and Rey (2007a)	1973-2004	3.30	6.80	3.50	Implied returns
		-0.78	**6.24**	**7.02**	
Lane and Melesi-Ferreti (2005)	1995-2004	2.70	7.20	4.50	Implied returns
		-0.59	**7.34**	**7.92**	
Obstfeld and Rogoff (2005)	1983-2003	3.10	-	-	Implied returns
		0.19	**7.25**	**7.06**	
Curcuru et al. (2008)	1994-2005	0.72	8.32	7.60	Market data
		6.97	**11.01**	**4.04**	
Forbes (2010)	2002-2006	6.90	11.20	4.30	Market data
		0.59	**7.37**	**6.78**	
Gourinchas et al. (2010)	1973-2009	1.60	5.00	3.40	Implied, excludes OC
		1.84	**4.91**	**3.07**	
Curcuru et al. (2010)	2001-2011	2.80	6.70	3.90	Implied, revised data
		-0.22	**6.22**	**6.43**	
Gohrband and Howell (2015)	1990-2005	1.50	7.60	6.10	Implied, revised data

The accuracy in estimating portfolio returns has been a topic of ample debate in the literature.Table 2.1 compares the portfolio return differentials from different data sets with those from the data used in this article. A first wave of studies calculated portfolio returns implied from U.S. NIIP data (see Lane and Milesi-Ferretti (2005); Meissner and Taylor (2006) and Obstfeld and Rogoff (2005)), obtaining large return differentials. Later, Curcuru et al (2008) argued that these implied returns were upward biased due to inconsistencies in the different sources of data for flows and positions. They calculate portfolio returns from market prices, as Gourinchas and Rey (2007) do, obtaining smaller return differentials. Recent research from the BEA, the compilers of the NIIP data, does also find lower estimates of portfolio return differentials than those obtained from the implied returns in the first wave of papers, pointing out that NIIP data should not be used to obtain returns (see Gohrband and Howell (2015)). Returns are more similar among data sets obtained from market prices and revised data. To the best of my knowledge the quarterly data on portfolio return used in this article is the only one using market prices that covers both the fixed exchange rate and the floating exchange rate regimes for the US dollar.

2.4 Empirical Analysis

In this section I empirically estimate the two components on the right hand side of equation (2.4) following standard time series methods developed by Campbell and Shiller (1987). I also compute the percentage of the variance of nxa_t that can be explained from each of these two terms (the valuation and the trade components) and check if under the restrictions imposed by the empirical specification, equation (2.4) holds. I take expectations on equation (2.4) conditional on Ω^*, with $\Omega^* = \{nxa_{t-i}, \Delta nx_{t-i}, r^{NFA}_{t-i}\}_{i\geq 0}$. Notice that Ω^* is a subset of Ω, the period-t information. Then I obtain the following equation:

$$nxa_t \approx -\sum_{i=1}^{\infty} \rho^i E(r^{NFA}_{t+i} + \Delta nx_{t+i} | \Omega^*_t) \tag{2.5}$$

Notice that Ω^* contains all the information agents are using to calculate $E(r^{NFA}_{t+i} + \Delta nx_{t+i})$. In order to estimate the valuation and trade components I use a VAR formulation. First, I set a VAR(p) representation with $z_t = (r^{NFA}_t, \Delta nx_t, nxa_t)'$. All variables are demeaned.

$$z_t = A(L)z_{t-1} + \epsilon_t$$

where ϵ_t is a vector of zero mean errors. The VAR has the following first order companion representation:

$$Z_t = \bar{A}Z_{t-1} + \bar{\epsilon}_t$$

where $Z_t = (z'_t, ..., z'_{t-p+1})$ and $\bar{\epsilon}_t = (\epsilon_t, 0)$. Next, I define the vectors $e_r, e_{\Delta nx}, e_{nxa}$ such that they select the different elements of Z_t (for example $e'_r Z_t = r^{NFA}_t$). I can express equation (2.4) in terms of the VAR formulation.

$$e'_{nxa} Z_t = -(e'_r + e'_{\Delta nx}) \sum_{i=1}^{\infty} \rho^i E_t Z_{t+i}$$

Notice that $E_t Z_{t+j} = \bar{A}^j Z_t$, where $\bar{A}^j$ denotes j multiplications of the $\bar{A}$ matrix. Using this last result, I obtain the following expression:

$$\begin{aligned} e'_{nxa} Z_t =& -(e'_r + e'_{\Delta nx}) \sum_{i=1}^{\infty} \rho^i \bar{A}^i Z_t \\ =& -(e'_r + e'_{\Delta nx}) \rho \bar{A}(I - \rho \bar{A})^{-1} Z_t \\ =& nxa_t^r + nxa_t^{\Delta nx} \end{aligned} \tag{2.6}$$

The valuation and trade components are:

$$nxa_t^r = e'_r \rho \bar{A}(I - \rho \bar{A})^{-1} Z_t = \sum_{i=1}^{\infty} \rho^i \bar{A}^i E(r_{t+i}^{NFA} | \Omega_t^*)$$

$$nxa_t^{\Delta nx} = e'_{\Delta nx} \rho \bar{A}(I - \rho \bar{A})^{-1} Z_t = \sum_{i=1}^{\infty} \rho^i \bar{A}^i E(\Delta nx_{t+i} | \Omega_t^*)$$

When estimating the valuation and trade components I am assuming that the forecast of future changes in fundamentals, $E(r_{t+i}^{NFA} + \Delta nx_{t+i})$, can be computed from the VAR as $(e'_r + e'_{\Delta nx}) \bar{A}^i Z_t$. These forecasts only represent the best forecasts of $r_{t+i}^{NFA} + \Delta nx_{t+i}$ that can be computed using linear combinations of the variables in Z_t. If the processes I am forecasting are non linear it may be the case that even if equation (2.4) holds, its empirical counterpart (2.5) does not. Also, the predicted values for the valuation and trade components, nxa_t^r and $nxa^{\Delta nx}$, will be sensitive to the choice of variables included in the VAR. Increasing the number of variables in the VAR such that $z_t = (r_t^{NFA}; \Delta nx_t; nxa_t; \omega_t)$ may change the forecast of the valuation and trade components depending on the additional variables we include in ω_t. Importantly, as I mentioned before, this will not happen with $nxa_t^r + nxa^{\Delta nx_t}$ given that $\Omega^* = \{nxa_{t-i}, \Delta nx_{t-i}, r_{t-i}^{NFA}\}_{i \geq 0}$ contains all the information agents are using to calculate that term. Finally, in order to find out the contribution of the valuation and trade components to the external adjustment, I perform the following variance decomposition:

$$\begin{aligned} 1 =& \frac{Cov(nxa, nxa)}{Var(nxa)} = \frac{Cov(nxa^r, nxa)}{Var(nxa)} + \frac{Cov(nxa^{\Delta nx}, nxa)}{Var(nxa)} \\ =& \beta_r + \beta_{\Delta nx} \end{aligned} \tag{2.7}$$

The regression coefficients β_r and $\beta_{\Delta nx}$ represent the share on the unconditional variance of nxa explained by the valuation component nxa^r and the trade component $nxa^{\Delta nx}$. I can empirically estimate nxa, the valuation and trade components as well as the regression coefficients β_r and $\beta_{\Delta nx}$ using the VAR estimates. Let $\hat{A}$ denote the estimated companion matrix from the VAR. The predicted value for the nxa_t based on our VAR estimates will be:

$$\begin{aligned}\widehat{nxa}_t &= -(e_r' + e_{\Delta nx}')\rho\hat{A}(I-\rho\hat{A})^{-1}Z_t \\ &= \widehat{nxa_t^r} + \widehat{nxa_t^{\Delta nx}}\end{aligned} \tag{2.8}$$

From the OLS regressions of $\widehat{nxa_t^r}$ and $\widehat{nxa_t^{\Delta nx}}$ on nxa_t, I can compute the variance contribution of the estimated valuation and trade components. One way to asses the quality of the approximation in equation (2.4) and the validity of the assumptions behind the empirical equation (2.5) is to check how much of the variance of nxa_t can be explained by $\widehat{nxa_t^r}$ and $\widehat{nxa_t^{\Delta nx}}$. If the approximation is good and equation (2.5) holds, the valuation and trade components should account for all the variance of the net external position. I use the variance decomposition from equation (2.7) to check this out.

I find that the valuation and trade components are able to explain just 68.72% of the variance of the U.S. net external position for the whole sample (1952:I-2015:III). As I pointed out previously, if there are non-linearities such as structural breaks in the variance of the processes governing the behavior of the estimated forecasts, the linear projections will not be able to correctly estimate them. Next, I perform a variance decomposition using different sub-samples. I use the value of ρ that maximizes the total explained variance for each sub-sample with $\rho \in (0,1)$. Each period begins at a different date and ends on 2015:III. Figure 2 shows the percentage of the unconditional variance of nxa explained by the trade and valuation components for these different sub-samples.[12]

Figure 2.2 shows two different periods with a different percentage of explained variance, and a transitional phase that lasts approximately from 1971:IV to 1972:IV. The estimated trade and valuation components are able to account for all the variance of the net external position for periods beginning since 1973. For sub-samples including dates before 1973 these two estimated components do not account for all the variance. The transitional period coincides with the time the fixed exchange rate regime collapsed. At the beginning of the 70s there were several events that changed the exchange rate regime of the dollar. During August 1971 the U.S. government suspended convertibility of the dollar into gold for official transactions, suspended the use of swaps, imposed price controls

[12]The date on the horizontal axis refers to the beginning of the sub-sample with all of them ending on 2015:III.

and a 10 percent import surcharge and announced no further intervention to support the currency; all countries with major currencies except France started to float, imposed exchange controls, and undertake major interventions to buy dollars. Then, after massive interventions by foreign exchange authorities, the system of fixed exchange rates collapsed into generalized floating in March 1973.[13]

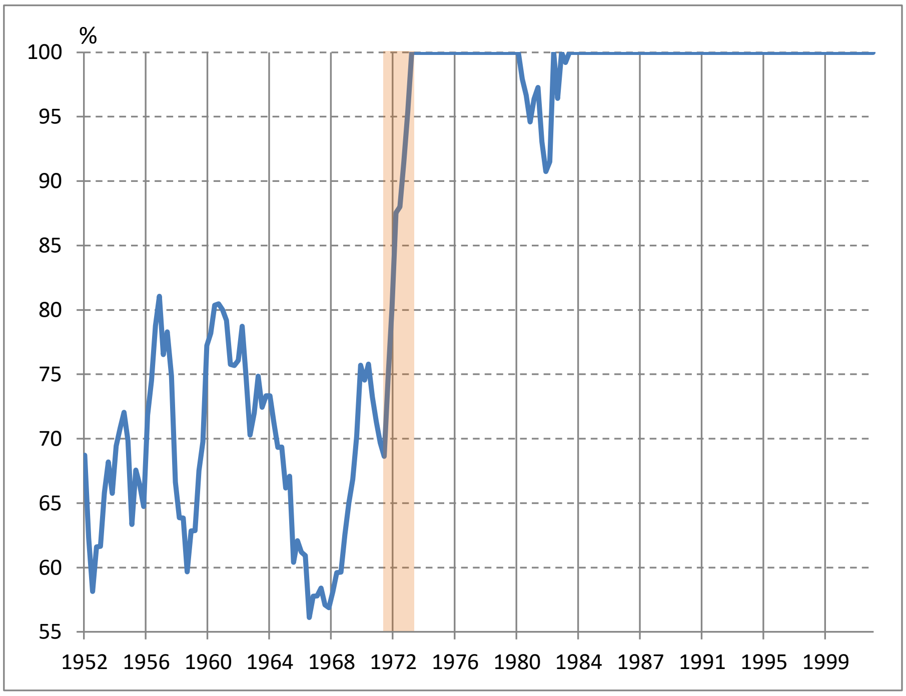

Figure 2.2: Explained variance of U.S. net external position

The estimated valuation and trade components are obtained using forecast of future changes in fundamentals, $E(r^{NFA}_{t+i} + \Delta nx_{t+i}|\Omega^*_t)$. These forecasts come from a VAR specification that consist of linear combinations of the variables in z_t. If the processes governing these variables are non linear during the period of study, any linear model is misspecified. The change in the percentage of the explained variance identifies the point that separates two different regimes for the behavior of the U.S. net external position. Thus, it seems that it is the change on the moments of the variables in the VAR what makes linear projections no capable to fully characterize the dynamics of the series over periods that include both foreign exchange regimes.

The fact that the estimated valuation and trade components are not capable to explain all the variance of the U.S. net external position can be attributed to other reasons. First, it may be due to the approximation error that comes from the first

[13]See Garber (1993).

order Taylor approximations applied to obtain equation (2.4). The approximation error may be also due to data inaccuracies or missing data. Figure 2.3 shows that this error is small and stationary. Also, the behavior of the error term does not change after the break point.[14]

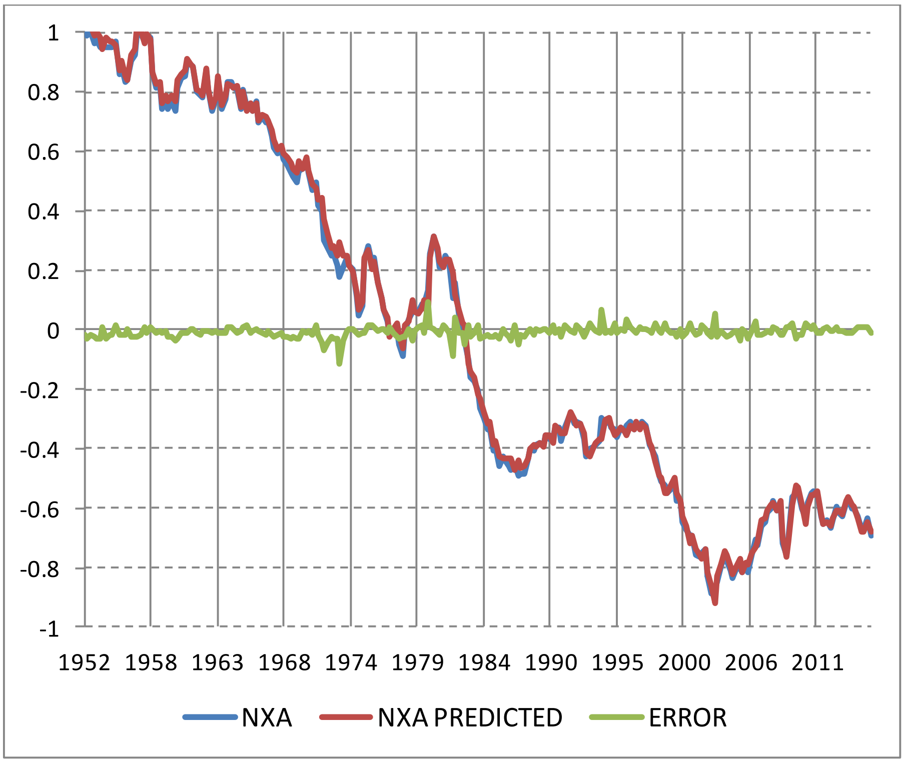

Figure 2.3: Approximation error

Second, it may be that the non-Ponzi game condition imposed to obtain equation (2.4) does not hold. This condition implies that the U.S. fully honors its international debt. From a theoretical perspective, the assumption rests on the widely-accepted premise that the perceived likelihood of default for U.S. debt has been negligible over the past 50 years. From a practical point of view, Bohn (2007) proves that intertemporal budget constraints of the kind presented in equation (2.4) satisfy the transversality condition (non-ponzi game condition) under some mild assumptions on the behavior of the variable representing the stock of debt. For instance, if a debt series is integrated of order m for any finite $m \geq 0$, then the debt variable satisfies the transversality condition and the intertemporal budget constraint holds.

[14]To confirm this fact I run standard tests of structural breaks in mean and volatility developed by Bai and Perron (1998) and Inclan and Tiao (1994) and I do not find any breaks in the error term. Full details of those test are developed in the next sections.

Third, I assumed that it is possible to fully characterize the behavior of the variables in the vector z_t from a VAR(p). I employed both the Akaike and the Schwarz criteria to obtain the optimal number of lags for each of the sub-samples in Figure 2.3 . The optimal number of lags is one for all sub-samples using any of the two criteria. The results shown on Figure 2.3 are obtained under the VAR(1) specification. I also perform the same analysis allowing for higher order of lags and I consistently find the same break in the explained variance.

In order to check that the non-linearities behind the VAR are due to the end of the fixed foreign exchange regime, I divide the data into two sub-samples, one that covers the period before the break (fixed exchange rate regime) and another one that covers the period after the break (floating exchange rate regime). I find that the linear projections behind the VAR can fully characterize the dynamics of the data for each of the two sub-periods. The estimated valuation and trade components can fully explain the total variance of the U.S. net external position. Regarding the importance of the valuation and trade components during the two sub-periods, the contribution of the valuation component is larger during the floating period. Table 2.2 shows the results of the variance decomposition of nxa for different periods. The contribution of the valuation component increases from explaining 28.79% of the variance of the U.S. net external position during the fixed exchange-rate period to 53.55% during the floating period. The estimation of the valuation and trade component may change if there are additional variables that influence the expectations obtained by the VAR estimation. I add other variables to the VAR such as the foreign exchange, long-term interest rates, real GDP and the debt to GDP ratio, consistently finding a large increase of the variance explained by the valuation component during the floating period.

Table 2.2: Unconditional variance decomposition of U.S. external position

	1952:I-2015:III Whole Sample	1952::I-1971:II (Pre-Break)	1973:I-2015:IV (Post-Break)
β_r	31.46	24.63	51.75
$\beta_{\Delta nx}$	37.27	75.34	48.22
Total	68.73	99.98	99.97

Note: β_r ($\beta_{\Delta nx}$) represents the share of the unconditional variance of nxa explained by the valuation (trade) component.

This large increase could be driven by other reasons than the change in the foreign exchange regime. For instance, it may be the case that a large part of the valuation component anticipates future changes in the price of assets instead of a depreciation of the real exchange rate. In order to investigate this issue I perform a simple exercise. I re-estimate the VAR including an extra variable that accounts for the contemporaneous relationship between the real exchange rate and the portfolio return differential. This variable includes the part of the portfolio return differential that is related to the real exchange rate. From this estimation, I obtain an *exchange rate component of the valuation channel* that determines the part of the external imbalance that is adjusted due to the valuation component via the real exchange rate.

Figure 2.4 shows the exchange rate component of the valuation channel along with *nxa* and the valuation component itself. This exchange rate valuation component is able to explain 19% of the variance of the U.S. net external position during the floating period. This figure diminishes to only 1% over the period of fixed exchange rate. During the floating period the real exchange rate plays a much larger role in adjusting the U.S. external imbalance trough valuation effects. Moreover, a relevant part of the future external adjustment related to the valuation component will happen through real exchange rate depreciation.

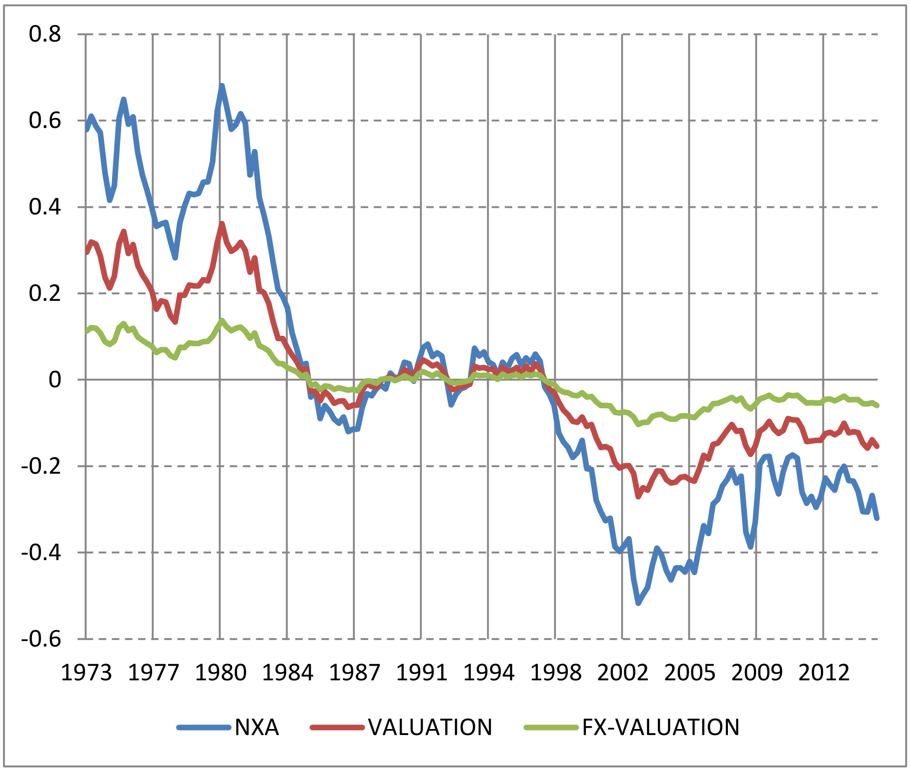

Figure 2.4: Exchange rate-valuation component

Finally, I compute sample statistics of the three variables included in the VAR for the two sub-periods with different exchange rate regime. Table 2.3 presents the standard deviation and mean of each variable for each period. The net external position shows a larger variance over the floating period, as well as the portfolio return differential. This is not the case for net exports growth. It seems that the larger variance of the next external position observed during the floating period is related to the portfolio return differential and the valuation component. I come back to this issue in the next section. Regarding the mean, the net external position changes from a creditor to a debtor position during the flexible exchange rate regime period; while the mean of the portfolio return differential and net exports growth show similar values for both periods.

Table 2.3: Sample statistics for different exchange rate regimes

	Fixed FX- 1952:1972			Floating FX- 1973:2015		
	nxa	r^{NFA}	Δnx	nxa	r^{NFA}	Δnx
Std. deviation	0.196	0.013	0.046	0.321	0.027	0.030
Mean	0.754	0.000	-0.001	-0.366	0.000	0.001

Note: The table shows sample statistics of the three variables included in the VAR. nxa represents the net external position; r^{NFA} the portfolio return differential and Δnx the growth in net exports.

2.5 Further evidence: Testing for strctural breaks

In the previous section, I have documented a change in the behavior of U.S. net external position at the end of the Bretton Woods system of fixed exchange rates, by analyzing the non-linearities of the variables included in the VAR. Next, I document this finding applying structural break tests at unknown dates both for multivariate and univariate series. I apply first the test of structural breaks for a system of equations using the VAR developed in the previous section. To provide robustness to the previous results, I next individually analyze the series included in the VAR.

2.5.1 Test of Structural Breaks in a System of Equations

Qu and Perron (2007) provide a framework to analyze series with multiple structural changes that occur at unknown dates in linear multivariate regression models, such as VARs. The breaks may happen in the parameters of the conditional mean, in the covariance matrix of the errors, or both, and the distribution of the regressors is also allowed to change across regimes. This is important because the tests determine whether or not the breaks in mean and variance happen at the same time. The framework used by these authors is the following:

$$y_t = (I \otimes z_t^{'}) S\beta_t + u_t$$

There are n equations and T observations, excluding the initial conditions if lagged dependent variables are used as the regressors. The total number of structural changes in the system is m and the break dates are denoted by the vectors $(T_1, \ldots\ldots, T_m)$ with the convention of $T_0 = 1$ and $T_{(m+1)} = T$. A subscript j indexes a regime $(j = 1, ..., m+1)$, a subscript t indexes a temporal observation $(t = 1, ..., T)$, and a subscript i indexes the equation $(i = 1, ..., n)$ to which a scalar dependent variable y_i, is associated. The parameter q is the number of regressors and z, is the set that includes the regressors from all equations $z_t, = (z_{1t}, ..., z_{qt})^{'}$. Finally, u has zero mean and covariance matrix Σ_j for $T_{j-1} + 1 \leq t \leq T_j (j = 1, ..., m+1)$. When using a VAR model as in this case we have that $z_t = (y_{t-1}, ..., y_{t-q})$, which contains the lagged dependent variables. I use a VAR(1) following the results from the Akaike and the Schwarz criteria that select the optimal number of lags.

In order to construct the test of the null hypothesis of no break versus the alternative hypothesis of some unknown number of breaks between 1 and some upper bound M, I first use the $UDmaxLRT(M)$ and $WDmaxLRT(M)$ double maximum tests to see if at least one break is present. Then, if the test rejects this hypothesis, I consider a $SEQ_T(l+1|l)$ sequential procedure obtained from a global maximization of the likelihood function and based on a test of l versus $l+1$ changes.[15]. The covariance matrix of the errors is allowed to change and normality is assumed when testing for changes in the covariance matrix. We correct for serial correlation in the residuals and construct the robust covariance matrix by the method of Andrews (1991). No pre-whitening technique is applied. Finally, the distribution of the regressors is allowed to change in order to construct the confidence intervals. The results of the test are presented in Table 2.4 and indicate the presence of three breaks.

The test identifies three breaks in mean and variance: the first one at the early

[15]I carried out the procedure with a maximum number of breaks $m = 3$ and a trimming of 0.2, which means that the minimal length required is 50 observations.

Table 2.4: Analysis of structural breaks (Qu-Perron test)

Wd_{max}	Sequential test (l+1/l) l=1	l=2	Number of breaks	
169.134***	72.176***	43.675***	3	
	Date		CI(95%)	
Break I	1971:I		1970:III	1971:II
Break II	1984:I		1983:II	1984:III
Break III	1997:III		1997:III	2002:III

Note: Maximun number of breaks M=3 and trimming = 0.2; The covariance matrix of the error is allowed to change and normality is assumed when testing for changes in the covariance matrix; Serial correlation in the residual and robust covariance matrix is constructed by the method of Andrews (1991); No pre whitenning technique is applied; *,** and *** denote significance at the 10%, 5% and 1% levels, respectively.

70s, another one in 1984 and the last one at the end of the 90s. The first break coincides with the one already identified in the previous section. The structural break affects both the mean and the variance, suggesting a relationship between the variance of the net external position and its mean. Sample statistics of the three variables included in the VAR for the periods before and after the collapse of Bretton Woods provide an idea about the change in the behavior of the series after the break (see Table 2.3). The net external position shows a larger variance during the floating period; the same happens with the series of return differentials. The sample variance of the net external position during the floating period is more than twice that of the the Bretton Woods period. The sample variance of the portfolio return differential during the floating period is more than four times larger than the one during Bretton Woods. On the contrary, the change in net exports growth presents lower volatility after 1973. This is consistent with the results of the test that identify another break in the first quarter of 1984, which is associated to the Great Moderation.[16] Given that the variance of the net external position increases after the collapse of Bretton Woods, it seems that the larger

[16] Kim and Nelson (1999) and McConnell and Perez-Quiros (2000) are the first to document a structural break in the variance of U.S. GDP growth in the first quarter of 1984, characterized by a reduction in the variance of output growth. Gadea et al. (2014) show that the Great Moderation still holds for the U.S. GDP with updated data that includes the Great Recession and its subsequent recovery.

variance in the portfolio returns differential dominates over the lower variance in net exports growth. This is also consistent with the larger importance of the valuation component during the floating period documented in the previous section.

Regarding the level of the U.S. net external position, the floating period is characterized for a net debtor position while the fixed exchange rate period shows a positive external position. Finally, the results of the test identify another break at the third quarter of 1997, with a confidence interval at the 10% level that spans from 1997:III to 2002:III. It is difficult to relate this break with any particular event, but given the documented relation between the external imbalance and the exchange rate, the introduction of the euro may have influenced the result. The euro zone is an important trade partner of the U.S. and a large part of the U.S. foreign portfolio includes assets and liabilities denominated in euros.

2.5.2 Robustness Checks: Univariate tests of Structural Breaks

The two previous sections document a structural break in the mean and variance of the VAR that happened at the time of the collapse of the Bretton Woods system. In this section I test for structural breaks in mean and variance on each of the three series included in the VAR, to identify separately which breaks are present in each of them.

Inclan and Tiao (1994) proposed a test for the detection of changes in the unconditional variance of the series which belongs to the CUSUM-type test family and has been extensively used. The test is defined as follows:

$$IT = sup_k \left| \sqrt{T/2} D_k \right| where$$
$$D_k = \frac{C_k}{C_t} - \frac{k}{t} \; with \; D_0 = D_T = 0$$
$$C_k = \sum_{t=1}^{k} \epsilon_t^2$$

This test assumes that the innovations ϵ_t of the stochastic processes y_t are zero-mean normally, i.i.d. random variables and uses an Iterated Cumulative Sum of Squares (ICSS) to detect the number of breaks.

The results of the tests support those obtained from the Qu-Perron (2007) test and provide further insights about the external adjustment process.[17] Table 2.5

[17]Sanso et al (2004) show that the test proposed by Inclan and Tiao (1994) may produce wrong

shows the results of the test for each of the three variables: net external position (nxa), portfolio return differentials (r^{NFA}) and net exports growth (Δnx). The test finds three structural breaks in variance for the series of the net external position at the same points in time detected by the Qu-Perron (2007) test. It documents a first break at 1971:III, right at the same time the U.S. government suspends convertibility of the dollar into gold for official transactions. It documents the second break at 1984:II, right at the beginning of the Great Moderation. Finally, another break is documented at 1998:II, the one that could be related to the introduction of the euro. Additionally, running the test for the other two variables provides information on whether the breaks are driven either by changes in the portfolio returns differential or by changes in net exports growth. The test for the series of portfolio return differentials documents two breaks, one at 1970:III, which corresponds to the end of the fixed exchange rate regime and another one at 1999:II possibly related with the introduction of the euro. The variance of the series of portfolio return differentials do not structurally change due to the Great Moderation, a process that is linked to the real economy. On the contrary, the portfolio return differential seems to be mainly influenced by the nominal exchange rate regime. For the series of net exports growth the test identifies only one break at 1984:II, the beginning of the Great Moderation.

Table 2.5: Analysis of structural breaks in volatility (Inclan-Tiao methodology)

Series	Number of breaks	Breaks
nxa	3	1971:III 1984:III 1998:II
r^{NFA}	3	1970:III 1999:II
Δnx	3	1984:I

Note: Sanso et al. (2004) show that the Inclan and Tiao test may produce wrong results for leptokurtic and heteroskedastic series. I implement their proposed modification of the test for Δnx as it is leptokurtic. nxa represents the net external position, r^{NFA} the portfolio return differential and Δnx the growth of net exports.

It seems that the behavior of the U.S. net external position has been influenced

results for leptokurtic and heteroskedastic series. To overcome this drawback, they propose two corrections, which explicitly take the fourth order moment porperties of the disturbances and the conditional heteroskedasticity into account. I implement their proposed modification when analyzing the series of net exports growth because it is leptokurtic.

by the nominal exchange rate regime through the portfolio return differentials (valuation component) and also by the growth of net exports (trade component). Both the net external position and the portfolio return differentials show larger variance during the period after the collapse of the fixed exchange rate regime. This is consistent with previous studies documenting a more volatile real exchange rate under floating nominal regimes (Morales-Zurraquemo and Sosvilla-Rivero (2010)). The influence of net exports growth goes in the opposite direction as there is a reduction in the volatility of the series. The fact that the volatility of the net external position increases, denotes that the valuation component is more important in determining the behavior of the net external position during the floating period as it is shown in the previous section. To sum up, the test performed using the methodology proposed by Qu-Perron (2007) documents structural breaks on the VAR specification in mean and variance. Using the methods developed by Inclan and Tiao (1994), I document structural breaks in variance at the same dates for each of the three series included in the VAR.

Finally, I also analyze whether each of the series have structural breaks in mean by applying the tests developed by Bai-Perron (1998). Table 2.6 shows the results of the test. It documents four structural breaks in mean for the net external position, three of the them coinciding with the ones documented both by applying the Qu-Perron (2007) and Inclan-Tiao (1994) methodologies. These results confirm that the structural breaks previously documented imply a change not only in the variance of the external imbalance but also in the mean. The structural breaks in mean show that the exchange rate regime affects the level of the U.S. external position, being a potential driver of increases or decreases. The other two series (net exports growth and portfolio returns) do not present any structural breaks in mean.

Table 2.6: Analysis of structural breaks in mean (Bai-Perron test)

	nxa	r^{NFA}	Δnx
$supF_{(k)}$			
$k = 1$	963.33***	2.97	2.32
$k = 2$	1632.09***	3.26	2.47
$k = 3$	2069.01***	3.25	2.34
$k = 4$	2117.38***	2.63	2.63
$supF_{(l+1/l)}$			
$l = 0$	923.87***	1.38	5.55
$l = 1$	660.67***		
$l = 2$	352.59***		
$l = 3$	75.13***		
UD_{max}	211.39***	3.26	2.63
WD_{max}	3640.70***	4.68	4.75
Break dates	1961:IV		
	1971:III		
	1983:III		
	1998:IV		

Note: The table shows the results of the test for changes in the mean of the three variables included in the VAR. nxa represents the net external position, r^{NFA} the portfolio return differential and Δnx the growth of net exports. Serial correlation and heterogeneity in the errors are allowed. The consistent covariance matrix is constructed using the method developed by Andrews (1991).

2.6 Asset pricing implications

Given the results in previous sections, it is expected that the U.S. external imbalance has some explanatory power over the evolution of the foreign exchange. This relationship has already been documented by Gourinchas and Rey (2007) and Evans and Fuertes (2011), although none of these papers study the implications of different exchange rates regimes. I check whether the exchange rate regime influences the external adjustment process by regressing the changes in the real exchange rate on the net external position, a dummy variable identifying the exchange rate regime and an interaction term between the external position and the dummy. This interaction term will be the main variable of interest given that a statistical significant coefficient will imply a different relation between the foreign exchange and the net external position depending on the nominal foreign exchange regime. I compute the OLS estimates of

$$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \beta_2 FXd_t + \beta_3 nxa_t * FXd_t + \nu_{t+k} \tag{2.9}$$

for different horizons $k = \{1, 4, 8\}$. $\Delta^k e_{t+k}$ is the real dollar depreciation rate and FXd_t is the dummy variable that identifies the foreign exchange regime (equals one during the fixed exchange rate period). For comparison purposes, I also compute the regression without the foreign exchange regime dummy and the interaction term.

Table 2.7 shows the results of the regressions with robust standard errors in parenthesis. The left hand side shows the results of the regression without the foreign exchange regime dummy and the interaction term. The right hand side shows the result from the regression of equation (2.9). The top panel shows the results of the regressions using the U.S. trade weighted foreign exchange depreciation as the dependent variable. The U.S. external imbalance does not have any predictive power over the future foreign exchange depreciation at any horizon in the left hand side regression. On the contrary, when including in the regression the exchange rate regime dummy and the interaction term, the coefficients turn statistically significant. The relationship between the external imbalance and future changes in the real exchange rates differs depending on the period. During the Bretton Woods system of fixed exchange rates, changes in the external imbalance triggered larger movements of the real exchange rate than during the floating period. The sign of the coefficients is positive as expected: a deterioration on the external imbalance implies a future depreciation of the dollar. Also, the R^2 increases substantially in the right hand side regressions, reaching 15.7% over an horizon of 8 quarters compared to only 0.1% for the regression that does not take into account the foreign exchange regime.

To check the robustness of the previous results I run the same regressions for different currencies. The second panel of Table 2.7 presents the results for the foreign exchange of the dollar against the British pound (GBP/USD) . The regressions with the GBP/USD produce the largest R^2, reaching 50% over an horizon of 8 quarters when the dummy and the interaction term are included. In this case during the fixed exchange rate period a deterioration in the U.S. external imbalance implies future appreciation of the dollar. This could be consistent with the valuation component being the main adjustment mechanism during

Table 2.7: Forecasting exchange rates with the net external position. Exchange rate regime effect

	$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \nu_{t+k}$ (1)			$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \beta_2 FXd_t$ $+\beta_3(nxa_t * FXd_t) + \nu_{t+k}$ (2)		
	Trade Weighted			**Trade Weighted**		
Horizon	1	4	8	1	4	8
β_1	-0.0003	0.0007	0.0008	0.0070	0.0095***	0.0096***
	(0.0036)	(0.0019)	(0.0015)	(0.0073)	(0.0034)	(0.0026)
β_3				0.0349	0.0285***	0.0234***
				(0.0217)	(0.0069)	(0.0052)
R^2	0.0000	0.0005	0.0010	0.0254	0.0930.	0.1571
	GBP/USD			**GBP/USD**		
Horizon	1	4	8	1	4	8
β_1	0.0150***	0.0167***	0.0169***	0.0500***	0.0534***	0.0511***
	(0.0043)	(0.0029)	(0.0024)	(0.0105)	(0.0053)	(0.0038)
β_3				-0.0565***	0.0767***	-0.0781***
				(0.0237)	(0.0088)	(0.0060)
R^2	0.0328	0.1107	0.1826	0.1045	0.3325	0.5021
	JPY/USD			**JPY/USD**		
Horizon	1	4	8	1	4	8
β_1	-0.0055	-0.0061	0.0069	-0.0020	-0.0024	-0.0040
	(0.0040)	(0.0023)	(0.0018)	(0.0109)	(0.0065)	(0.0048)
β_3				0.0590***	0.0449***	0.0374***
				(0.0213)	(0.0100)	(0.0080)
R^2	0.0046	0.0153	0.0338	0.0267	0.0543	0.0789
	DEM/USD			**DEM/USD**		
Horizon	1	4	8	1	4	8
β_1	-0.0005	0.0003	0.0004	0.0143	0.0196***	0.0196***
	(0.0043)	(0.0024)	(0.0017)	(0.0132)	(0.0064)	(0.0046)
β_3				0.0367	0.0301***	0.0221***
				(0.0235)	(0.0123)	(0.0072)
R^2	0.0000	0.0000	0.0001	0.0275	0.1054	0.1651

Note:Left (right) hand panel shows the results of the regression 1 (2). $\Delta^k e_{t+k}$ is the rate change of the dollar for different horizons $k = 1, 4, 8$. FXd_t is a dummy variable equal to 1 if there is a fixed exchange rate regime. nxa_t is the net external position. Standard errors in parenthesis.*,** and *** denote significance at the 10%, 5% and 1% levels, respectively that period, and the composition of UK external assets and liabilities such that foreign currency liabilities being greater than foreign currency assets. During the floating period the coefficient has the expected positive sign. The other two panels of Table 2.7 show the results for the Japanese yen (JPY/USD) and the Deutschmark (DEM/USD). For the yen, the U.S. external imbalance has very low predictability power and for the Deutschmark the results are similar to those obtained with the trade weighted exchange rate. The results presented in the last two panels confirm that the relation between the foreign exchange and the external imbalance changed after the collapse of the foreign exchange regime.

2.7 Conclusion

Research analyzing the implications of different exchange rate regimes to the process of external adjustment has focused on the current account as the main variable of interest, neglecting the importance of the valuation channel and considering the trade channel as the only mechanism to correct imbalances. A recent wave of empirical studies has pointed out the importance of valuation effects in the adjustment of external imbalances, being the real exchange rate a mayor player. The ignored valuation component may act reinforcing the trade channel of external adjustment or against it, depending on the currency composition of foreign assets and liabilities. Following a present value equation that relates current imbalances with future net exports growth and future portfolio return differentials I analyze the non-linearities behind a VAR specification that includes these three variables of study (the external imbalance, net exports growth and portfolio return differentials) and document a change on the behavior of the U.S. external position that happened when the Bretton Woods system of fixed exchange rates collapsed.

I further document this change by applying the methods developed by Qu and Perron (2007) to test for structural breaks in mean and variance at unknown dates in a system of equations. The test reveals not only a change in the volatility of the series but also a change in mean, suggesting that the large deterioration of the U.S. net external position could be related, at last to some extent, to the change in the nominal exchange rate regime. I also find evidence of another break that happened right before the introduction of the euro, signaling that the currency union may have affected the U.S. external adjustment path. The exchange rate regime mainly affects the valuation component of external adjustment, being the trade component more related to the real economy. For the series of net export growth I find a structural break at the beginning of the period known as the Great Moderation.

Finally, I analyze the asset pricing implications of the relationship between the exchange rate regime and the external adjustment process. I find that external imbalances have predictive power over future exchange rate depreciation once we take into account the exchange rate regime. The magnitude of future exchange rate depreciation induced by changes in the external imbalance also changes depending on the exchange rate regime.

The breaks documented in the U.S. external imbalance have important consequences for different theoretical and empirical techniques like calibration exercises and estimation of vector autoregression models over periods that span the break. Linear models for the U.S. net external position are misspecified over periods including both the fixed and the floating exchange rate regime.

The results of the paper continue the debate for policy analysis on the benefits of a fixed or a floating exchange rate regime to correct external imbalances. A fixed exchange rate regime could be preferred in case of adverse valuation effects (emerging economies with most of its liabilities denominated in foreign currency). If valuation effects facilitate the external adjustment, a floating regime could be better. In addition, there are also implications on how the external adjustment process is affected for a country that joins a monetary union. The structural break detected in the VAR and the portfolio return differential at the end of the 90s may signal the effects of the European Monetary Union on the U.S. external adjustment. Countries belonging to a monetary union may change their external adjustment process once they adopt the common currency. This may also have external solvency implications as it is highlighted by Camarero et al (2015).

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Appendix

A Approximation Accuracy

The following appendix describes the details and assumptions behind equations (2.1)-(2.2) in Section 2.2. We start as in Section 2.2 with the following accounting identity:

$$FA_t - FL_t \equiv X_t - M_t + R_t^{FA} FA_{t-1} - R_t^{FL} FL_{t-1} \tag{A.1}$$

where FA_t and FL_t are U.S. gross foreign assets and liabilities at the end of period t, X_t and M_t are U.S. exports and imports during period t, all measured in terms of the U.S. consumption index. R_t^{FA} and R_t^{FL} represent the gross real return on U.S. foreign assets and liabilities between the end of periods $t-1$ and t. Equation $(A.1)$ is non-linear and that complicates any further analysis. In order to study the implications of the budget constraint we develop some form of linearization for equation $(A.1)$.

Manipulating $(A.1)$ we get the following expression:

$$FA_t = FA_{t-1} R_t^{FA} \left(1 - \frac{M_t}{R_t^{FA} FA_{t-1}} + \chi_t\right) \tag{A.2}$$

where $\chi_t = \frac{FL_t}{R_t^{FA} FA_{t-1}} + \frac{X_t - R_t^{FL} FL_{t-1}}{R_t^{FA} FA_{t-1}}$. Then we log-linearize equation $(A.2)$, taking a first-order Taylor approximation around the point where $\chi = 0$ and $1 - \frac{M_t}{R_t^{FA} FA_{t-1}} = \rho \in (0,1)$. The log-linearization of $(A.2)$ produces:

$$\Delta fa_t \approx k + r_t^{FA} - \frac{1-\rho}{\rho}(m_t - r_t^{FA} - fa_{t-1}) + \frac{1}{\rho}\chi_t \tag{A.3}$$

where lower case letters denote natural logs of the corresponding upper case variables and $k = ln(\rho) + \frac{1-\rho}{\rho}(1-\rho)$. Now, manipulating the expression for χ_t:

$$\chi_t = \frac{FL_t}{R_t^{FA} FA_{t-1}} + \frac{X_t - R_t^{FL} FL_{t-1}}{R_t^{FA} FA_{t-1}} \quad \Rightarrow$$

$$\frac{FL_t}{R_t^{FA} FA_{t-1}} = \left(\left(1 - \frac{X_t}{R_t^{FL} FL_{t-1}}\right) \frac{R_t^{FL} FL_{t-1}}{R_t^{FA} FA_{t-1}} + \chi_t\right) \tag{A.4}$$

Next, we log-linearize the equation above taking another first-order Taylor approximation around the point where $1 - \frac{X_t}{R_t^{FL} FL_{t-1}} = \rho$, $\chi = 0$ and $\frac{R_t^{FL} FL_{t-1}}{R_t^{FA} FA_{t-1}} = 1$.

This log-linearization produces:

$$\Delta fl_t \approx k + r_t^{FL} - \frac{1-\rho}{\rho}(x_t - r_t^{FL} - fl_{t-1}) + \frac{1}{\rho}\chi_t \tag{A.5}$$

We combine equations $(A.3)$ and $(A.5)$ and define $NFA_t = \frac{R_t^{FA} FA_{t-1}}{R_t^{FL} FL_{t-1}}$ as the ratio of U.S. foreign assets to liabilities at the beginning of period t. As a result we can obtain the following equation:

$$nfa_t \approx r_t^{NFA} + \frac{1-\rho}{\rho} nx_{t-1} + \frac{1}{\rho} nfa_{t-1} \tag{A.6}$$

where $nx_t = x_t - m_t$ represents net exports and r_t^{NFA} is the return differential between foreign assets and liabilities. As a final step we define a new variable, $nxa_t = nfa_t + nx_t$ and rearrange the previous equation into the following one:

$$nxa_t \approx r_t^{NFA} + \Delta nx_t + \frac{1}{\rho} nxa_{t-1} \tag{A.7}$$

This last equation is the same one define as equation (2.2). Empirical analysis of equation (A.7) shows that the error term is small and stationary but the assumptions related with the first-order Taylor approximations require further analysis. The main purpose of this appendix is to understand the implications of the different assumptions used to perform the first-order Taylor approximations. Basically, We assume that the following ratios are stationary: $1 - \frac{M_t}{R_t^{FA} FA_{t-1}} = \rho$; $1 - \frac{X_t}{R_t^{FL} FL_{t-1}} = \rho$,and $\frac{R_t^{FL} FL_{t-1}}{R_t^{FA} FA_{t-1}} = 1$.

The first two ratios imply that the $1 - \frac{M_t}{R_t^{FA} FA_{t-1}} = 1 - \frac{X_t}{R_t^{FL} FL_{t-1}} = \rho$. Figure A.1 shows the ratios computed with U.S. data. Although they have behaved differently over the sample, both ratios seem to converge to a value which is consistent with the empirical value of ρ obtained to maximize the variance of the U.S. external position explained by the valuation and trade components.

Figure A.2 shows the other ratio, $\frac{R_t^{FL} FL_{t-1}}{R_t^{FA} FA_{t-1}} = 1$. Again, although the behavior of the series has been different over time it seems to converge to a value close to 1. In the end, the point used to make the first-order Taylor approximation resembles an economy where the stock of foreign assets and liabilities is much larger than the flow of exports and imports; and the volume of foreign assets and liabilities are similar. Empirical ratios from Figure A.1 and Figure A.2 show that

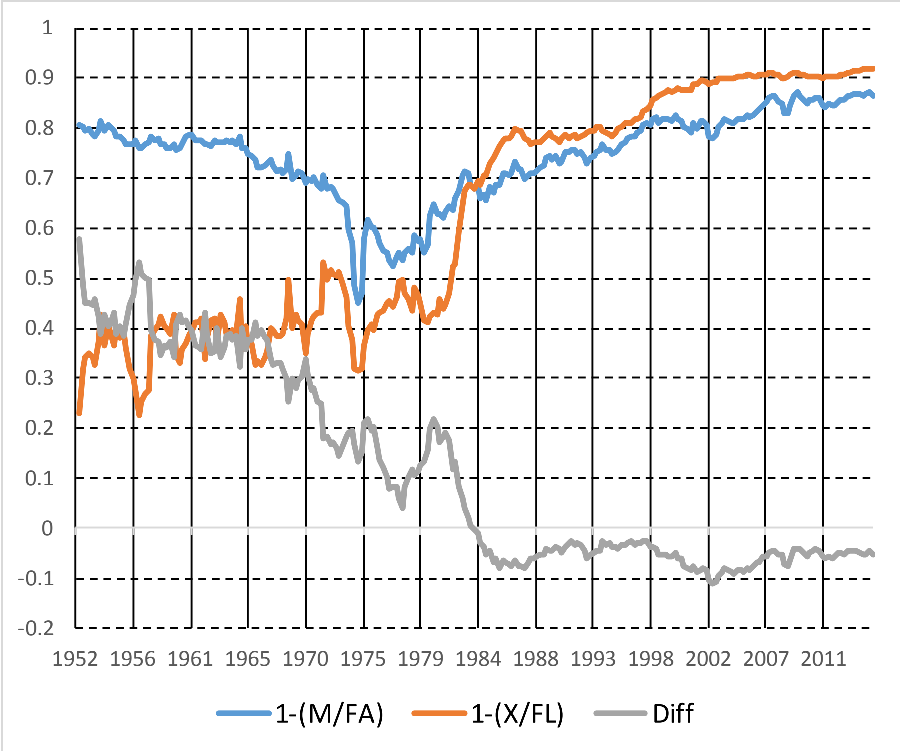

Figure A.1: Exports to foreign liabilities and imports to foreign asset ratios

these conditions are not inconsistent with current U.S. data.

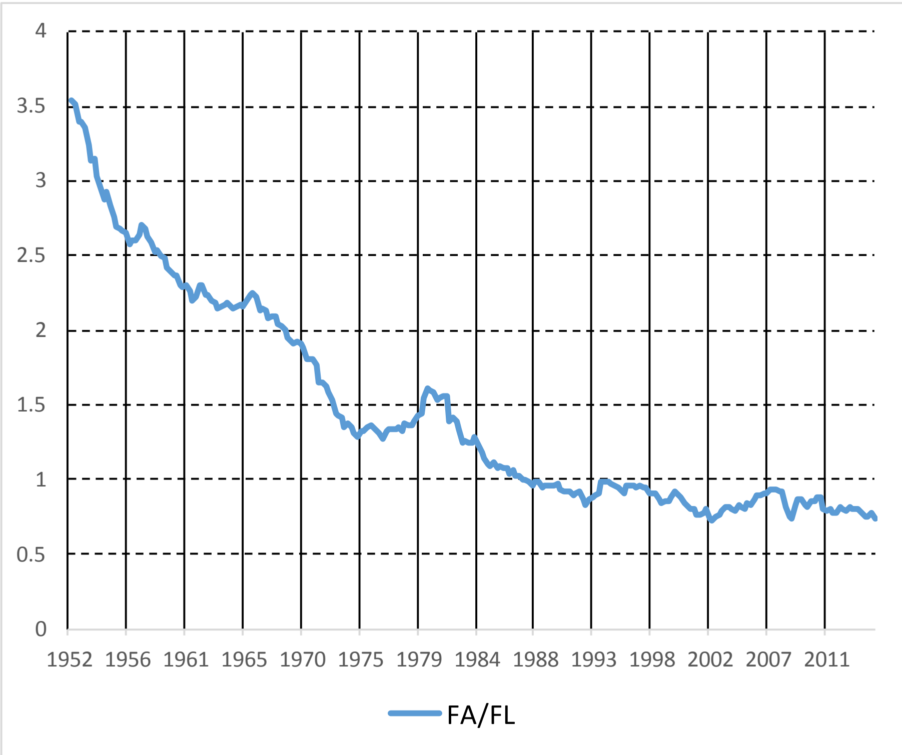

Figure A.2: Ratio of foreign assets to foreign liabilities

Chapter 3

External Adjustment with a Common Currency:The Case of the Euro Area

3.1 Introduction

The process of external adjustment within a common currency area has received little attention in the literature, despite the fact that an important mechanism of correction of imbalances, the nominal exchange rate, has been partially cancelled. The lack of nominal exchange rate adjustment for the bilateral transactions and external positions among the countries of the currency area may difficult the reduction of large net external liability positions. As an alternative, the more complicate and slower process of adjustment in product prices and wages (internal devaluation) may operate in the absence of the nominal foreign exchange. Keeping the net external position under control is crucial given that economies with large net liability positions are more vulnerable to capital markets disruptions and growing imbalances may trigger sustainability problems. These vulnerabilities were evident during the global financial crisis and the subsequent euro area crisis, as several economies experienced sudden stops, sovereign debt problems, or both. Moreover, recent research by Gadea et al. (2018) shows how external imbalances also affect the business cycle, as economies with large external imbalances experience slower recoveries.

At the end of 2017 the international investment position (IIP) of the euro area, the largest common currency union in the world, recorded a net liability position of 388 billion euros, representing 3.5% of its GDP. Even though this is almost a balanced position[1] there are large differences among countries, which have

[1]The U.S., for instance, had a negative IIP representing 39% of its GDP at the end of 2017.

become even larger after the inception the euro in 1999. For instance Germany amounts a net external creditor position representing 59% of its GDP at the end of 2017 while Spain shows a net debtor position representing 81% of its GDP[2]. Peripheral countries face the largest net liabilities positions in the euro area with Portugal, Greece and Ireland showing net external positions representing 105.8%, 140.9% and 148.3% of its GDP respectively (see Figure 3.1).

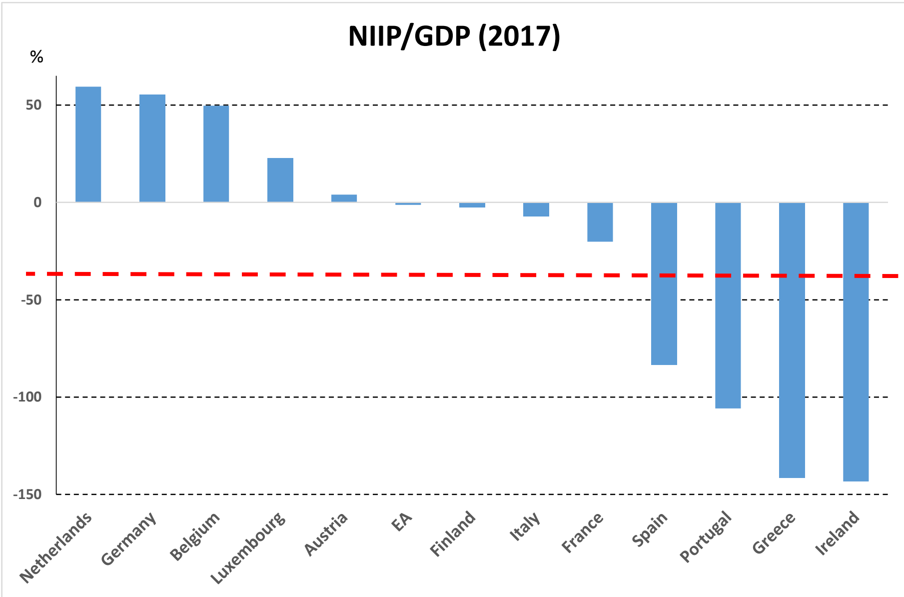

Figure 3.1: Net international investment postion to GDP ratio

The process of external adjustment for the countries within the euro area is different as these economies share a common currency. Gourinchas and Rey (2007) show that the dynamics of the exchange rate play a major role in the external adjustment process of the US since it has the dual role of changing the differential in rates of return between assets and liabilities denominated in different currencies (valuation component) and also of affecting future net exports (trade component). Lane and Shambaugh (2010) do also emphasize the impact of currency movements on the external positions for a large sample of countries. They find that the wealth effects associated with exchange rate changes are substantial and can explain a sizeable share of the overall valuation shocks that hit the net foreign asset position. Moreover, Fuertes (2019) shows the importance of the nominal exchange rate regime for the process of external adjustment in the US. He finds that the collapse of the Bretton Woods system of fixed exchange

[2]In absolute terms Spain holds the second largest net external debtor position in the world amounting 941.507 billion euros (1.108.386 billion dollars). The US is the country with the largest negative net external position totalling 7.725.002 billion dollars.

rates in 1973 affected the behaviour of the US net external position, implying an increase in the importance of the valuation component during the floating period. Given all the previous empirical evidence, it is expected that the inception of the common currency may have affected the external adjustment process for the countries of the euro area.

The introduction of the euro made the effects of nominal exchange rate changes to disappear among the countries in the currency area. First, a net debtor country could not rely anymore on foreign exchange depreciations to reduce the relative value of the local currency external debt held with the countries in the currency union. Similarly, a currency depreciation will not have any direct impact on the bilateral trade among the countries with the same currency [3]. Second, the behaviour of the exchange rate may not favour the external adjustment of all countries in the currency area, as foreign exchange movements will respond to the macroeconomic and monetary conditions of the whole currency union. For instance, a debtor country within the union that would benefit from an exchange rate depreciation to improve its external position may face an appreciating currency due to the macroeconomic situation of the other countries and the current monetary policy of the central bank. Because of these two reasons, changing from a floating to a fixed exchange rate regime within a common currency area may difficult the external adjustment and could be potentially dangerous for countries with large negative external positions. Understanding how the external adjustment process has evolved over time for the countries of the euro area and the implications of the introduction of the euro are the main research questions of the paper.

This work is related to the studies analyzing the external adjustment process, with an emphasis on the relevance of valuation effects and the nominal exchange rate regime. Friedman (1953) initiated the debate arguing that flexible exchange rates facilitate the correction of external imbalances by allowing an automatic adjustment in a context of nominal rigidities. Following this idea several studies have analyzed empirically the validity of this assumption by investigating how current account imbalances are corrected depending on the exchange rate regime. Gosh et al. (2014) find a robust relationship between the exchange rate regime and the speed of external adjustment confirming Friedman´s hypothesis. Similarly, Eguren-Martin (2016) finds evidence that flexible exchange rate arrangements deliver faster current account adjustment among non-industrial countries. Fuertes

[3]There may be second order effects as the depreciation could affect the terms of trade with the countries outside the currency area.

(2019) focuses on the consequences of a change in the exchange rate regime for the behaviour of the net external position, being the first study to analyze the adjustment of the net external imbalance instead of only focusing on the current account. He finds that the behaviour of the U.S. net external position changed at the end of the Bretton Woods system of fixed exchange rates in 1973, with the U.S. external imbalance increasing its variance and turning into a debtor position during the floating period. He also finds that the exchange rate regime affects the U.S. external adjustment process mainly through the valuation channel, which increased its relevance over the floating period. Previously, Gourinchas and Rey (2007) had already documented the importance of the valuation component for the external adjustment process, finding that this component explained 27% of the variance for the cyclical part of the US net external position. Further analysis by Evans and Fuertes (2011) and Evans (2012) show that the contribution to the external adjustment of the valuation component is larger than that of the trade component when analyzing the whole U.S. external imbalance and not only its cyclical part. Theoretical models have also emphasized the role of valuation effects on the dynamics of the net external position. Devereux and Sutherland (2010) present a DSGE model with portfolio choice capable to reproduce the dynamics of the valuation channel of external adjustment. The model can only generate unexpected valuation effects, being the anticipated ones small and reproduced at higher orders of approximation. Ghironi et al. (2015) also examine the valuation channel of external adjustment theoretically in a DSGE model, being able to separate asset prices and quantities in the definition of net foreign assets. This is more consistent with previous empirical work that has documented the relevance of expected valuation effects (see Gourinchas and Rey (2007), Evans and Fuertes (2011) and Evans (2012)).

In this paper I analyze the external adjustment path of the four main economies of the euro area, covering both the period before and after the introduction of the euro, to understand how the currency area affected the external adjustment process. In principle, the inception of the euro should have limited the capacity of the nominal exchange rate to correct external imbalances. This is evident as most of the research related to the correction of external imbalances in euro area countries has focused on the process of internal devaluation and its consequences, acknowledging the limited role of the nominal exchange rate. Different studies have analyzed theoretically and empirically how current account deficits should be transformed into surpluses by a combination of a decrease in domestic spending, real exchange rate depreciation and a reduction in unit labor costs[4].

To the best of my knowledge this is the first attempt to study the behaviour of the net external position for a set of euro area countries, including debtor and creditor countries, and analyzing the implications of the common currency area for their external adjustment paths.

Within this framework the main contributions of the paper are the following: First I build a novel data set of quarterly positions on assets and liabilities for the categories of equity, fixed income, direct investment and other assets/liabilities for France, Germany, Italy and Spain. The data set also includes estimates of quarterly total returns and capital gains for each of those categories. Second I find a structural break in the behaviour of the net external position for France, Italy and Spain at the time of the introduction of the euro, pointing out that the inception of the common currency changed the external adjustment process. The fact that Germany does not show this structural break is consistent with the exchange rate regime mainly affecting the valuation channel of external adjustment, given that the variance of Germany's net external position is almost completely explained by the trade channel. I also find a structural break for the external imbalances of Spain and Italy during the crisis of the European Exchange Mechanism (ERM) in 1992. Over this period the Italian lira and the Spanish peseta were devaluated and Italy abandoned the ERM.The importance of the valuation component of external adjustment increases after the introduction of the euro for France and Italy, and decreases for Germany and Spain. Third I also find that France and Italy will adjust the net external position mainly through the valuation component of external adjustment, while Germany and Spain will restore their external balance mostly through the trade component. Both the valuation and trade components have supported the evolution of the net external position in France, Italy and Spain. In the case of Germany the valuation component has limited the overall trend towards a larger creditor position, which has been driven by the trade component. Forth, in the absence of unexpected shocks, the half-live of the external imbalances is relatively short as Germany and Spain, the two countries with the largest imbalances, will be able to reduce their creditor and debtor positions by half in 7 and 3 years respectively. Finally, I documented asset pricing implications as the net external position has explanatory power over the future evolution of the exchange rate. A deterioration in the external imbalance of France, Italy and Spain implies a future depreciation of the euro, facilitating the

[4]See for example Atoyan et al. (2013), Kang and Shambaugh (2014), Eggertsson et al. (2013) or Andrés et al. (2018).

external adjustment through the trade component. On the contrary, for Germany, the behaviour of the common currency has hindered the external adjustment as it has supported the increase in its creditor position.

The paper proceeds as follows: Section 3.2 presents the data set. Section 3.3 includes most of the empirical analysis, including the structural break tests, the estimation of the valuation and trade components and asset pricing implications. Section 3.4 developed robustness regarding the calculation of the portfolio returns and Section 3.5 concludes.

3.2 Data

The data set includes information for France, Germany, Italy and Spain about their international investment position (IIP) as well as the external portfolio returns for assets and liabilities each period. The IIP data comes from the Balance of Payments Statistics (BOPS) of the IMF. Using the original data I obtain asset and liabilities positions for different categories: equity, direct investment, fixed income and other assets/liabilities. The data set is constructed following the same methodology employed by Gourinchas and Rey (2007). The IIP data from the BOPS comes on a quarterly frequency only for the more recent years and I estimate quarterly positions using portfolio flows and total returns to increase the sample period [5] . It is important that the data set include the years before and after the inception of the euro in order to fully characterise the changes triggered by the introduction of the common currency.

The other important part of the data set are the portfolio returns. The returns are computed from market prices for each of the asset/liabilities classes: equity, direct investment, fixed income and other assets/liabilities. In order to identify the market weights within the categories of equity, direct investment and fixed income[6] I use the Coordinated Direct Investment Survey (CDIS) and the Coordinated Portfolio Investment Survey (CPIS), both from the IMF. Once I have the market weights for each quarter and asset category I calculate total returns and capital gains for each market and compute the total portfolio return for the different categories using the market weights. For example, for the equity

[5] The data availability of the IIP at the quarterly and yearly frequency is different for each country, with the final estimated quarterly samples spanning from 1980: IV to 2017: I for Germany, Italy and Spain. For France the sample begins on 1989:III.

[6] For "other assets" I use the same market weights as those computed for short-term fixed income assets. For "other liabilities" I assume the total value is denominated in local currency using the same returns as those from short term fixed income liabilities.

assets category, I get from the CPIS the value of equity assets held in each foreign country to obtain geographical weights that will be used together with the returns of the corresponding benchmark equity index to compute the total return. The information contained in the market weights is also important because we can assess the portfolio value of the positions held with the other countries of the currency area. Figure 3.2 shows the percentage of foreign equity assets held in euro area countries for the four countries of analysis. As we can see all of them hold a relevance share of their equity assets portfolio in the euro area. Even though there is no information about euro area equity weights before 2001 it is reasonable to think that the introduction of the common currency may have changed the behaviour of capital gains. Before the introduction of the euro capital gains were determined both by asset prices and foreign exchange movements. After the introduction of the euro much of the capital gains coming from the equity assets portfolio were not affected by nominal exchange rate changes, being mainly determined by asset price changes[7]. This may have also affected the size and direction of external wealth effects, modifying the behaviour of the valuation channel of external adjustment.

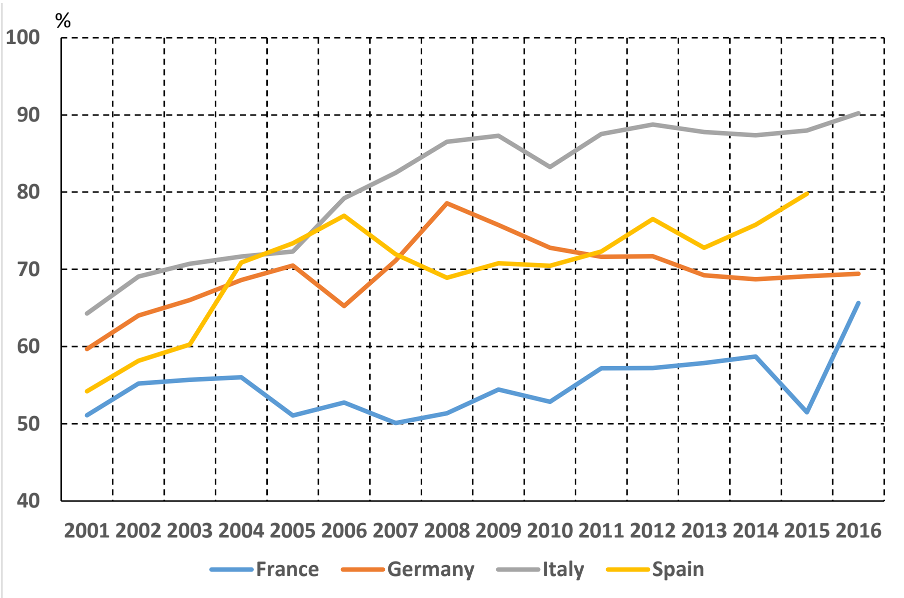

Figure 3.2: Portfolio equity weights for euro area postions

I complete the data set with information on imports and exports for each country[8]. We can asses the relevance of the commercial ties the four countries

[7]The other asset classes (FDI, fixed income and other assets) do also show a large share of euro area positions after the introduction of the common currency.

[8]The data sources are the NSEE France, ISTAT Italy, and the central banks of Germany and Spain

of analysis have with the rest of the euro area members. Figure 3.3 shows the share of imports plus exports traded with the rest of euro area countries. The four countries show shares over 40%, with a slightly declining trend over the last years. It is noticeable the large increase experienced by Spanish imports and exports since 1986, the year Spain joined the European Union. The large share of bilateral trade of the four countries with the rest of the euro area shows the potential impact that the common currency may have induced to the evolution of the net external imbalance, in this case through the trade channel of external adjustment.

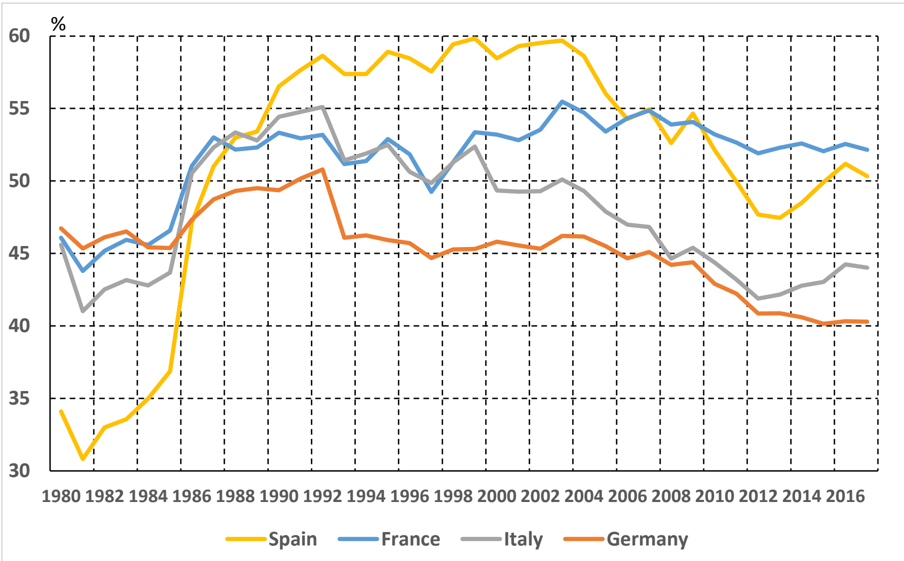

Figure 3.3: Exports plus imports weights for euro are trade

Finally, Table 3.1 shows the estimates of real portfolio returns for assets and liabilities as well as the return differentials. The table includes real returns for the complete sample as well as for the periods before and after the introduction of the euro. The only country able to obtain an average positive return differential over the whole period was Germany, with the other countries experiencing, on average, larger returns on their foreign liabilities than on their foreign assets. During the period after the introduction of the euro Spain was able to generate positive return differentials on average, while the other countries presented negative return differentials. The reduction of financing costs due to joining the euro area may have influenced the positive return differential obtained by Spain.

Table 3.1: Return differentials comparison (%)

	All sample			Pre-euro sample			Euro period		
	Difference	Claims	Liabilities	Difference	Claims	Liabilities	Difference	Claims	Liabilities
France	-0.76	2.87	3.63	-1.22	5.65	6.87	-0.56	1.43	1.99
Germany	0.38	4.04	3.65	1.26	6.53	6.53	-0.49	1.54	2.03
Italy	-1.18	2.99	4.17	-2.20	4.94	7.14	-0.15	1.04	1.19
Spain	-0.36	4.09	4.45	-1.58	6.03	7.61	0.92	2.03	1.11

Note: The data shows the average of quarterly returns annualized.

3.3 Empirical Analysis

In order to analyze the external adjustment process of a country Evans and Fuertes (2011) derive the present value relation for the net external position using several log-linearizations that include assumptions about the behaviour of different financial ratios[9]. I will next summarize the main steps to obtain this present value equation, which will be used as the starting point for the empirical analysis. A more detailed explanation of theses derivations can be also found in Section 2.2.

I start with the following equation:[10]

$$FA_t - FL_t \equiv X_t - M_t + R_t^{FA} FA_{t-1} - R_t^{FL} FL_{t-1} \tag{3.1}$$

Where FA_t and FL_t are gross foreign assets and liabilities at the end of period t, X_t and M_t are exports and imports during period t, all measured in terms of the consumption index. R_t^{FA} and R_t^{FL} represent gross real returns on foreign assets and liabilities between the end of periods $t-1$ and t. After several log-linearizations and some algebra I obtain the following relation:

$$nfa_t \approx r_t^{NFA} + \frac{1-\rho}{\rho} nx_{t-1} + \frac{1}{\rho} nfa_{t-1} \tag{3.2}$$

Where nfa_t is the log of the ratio of foreign assets to liabilities at the beginning of period t. r_t^{NFA} is the log of the return differential of foreign assets and liabilities and nx_t is the difference of the log of exports minus imports. ρ is a discount factor. Defining $nxa_t = nfa_t + nx_t$ and $\Delta nx_t = nx_t - nx_{t-1}$ I obtain the following

[9]See Evans and Fuertes (2011) and Fuertes (2019)

[10]The analysis does not include the secondary income which has been historically low for the four countries.

expression:

$$nxa_t \approx r_t^{NFA} + \Delta nx_t + \frac{1}{\rho} nxa_{t-1} \tag{3.3}$$

Iterating forward equation (3.3) and taking expectations conditioned on period t information, which includes de value of nxa_t , I obtain:

$$nxa_t \approx -E_t \sum_{i=1}^{\infty} \rho^i (r_{t+i}^{NFA} + \Delta nx_{t+i}) + E_t \lim_{i \to \infty} \rho^i (nxa_{t+i})$$

I impose the no-Ponzi game condition $E_t \lim_{i \to \infty} \rho^i (nxa_{t+i}) = 0$ on the equation above to rule out the possibility that a country defaults on its foreign claims. The next equation shows the present value relation between the variable nxa_t and future expected portfolio return differentials and net exports growth,[11]

$$nxa_t \approx -E_t \sum_{i=1}^{\infty} \rho^i (r_{t+i}^{NFA} + \Delta nx_{t+i}) \tag{3.4}$$

I will use nxa_t as the variable of interest that measures external imbalances, being the two terms at the right hand side of the equation the valuation component and the trade component respectively. This equation shows how current imbalances will be corrected in the future. Equation (3.4) implies that the net external position can only vary if it forecasts changes in portfolio returns or if it forecasts changes in net exports growth. If $E_t \sum_{i=1}^{\infty} \rho^i r_{t+i}^{NFA} = 0$, any adjustment of the net external position will come from future changes in net exports growth (trade component). On the other hand, if $E_t \sum_{i=1}^{\infty} \rho^i \Delta nx_{t+i} = 0$, any adjustment will come from future changes in portfolio returns (valuation component).

Next we need to characterise the joint behaviour of the variables involved in equation (3.4) in order to estimate the valuation and the trade components. This will allow us to test if there are any changes in the net external position due to the introduction of the common currency and it will also provide evidence on the different contributions of the valuation and trade components depending on the foreign exchange regime. I follow the methods developed by Campbell and Shiller (1987) (see also Evans and Fuertes (2011) and Fuertes (2019)). In order to estimate the valuation and trade components I use a VAR formulation. First, I set a VAR(p) representation with $z_t = (r_t^{NFA}, \Delta nx_t, nxa_t)'$. All variables

[11]In deriving equation (3.4) I have performed several first order approximations. To assess the accuracy of those approximations we can compute the error term from equation (3.3) which also includes any measurement errors from the original data. The error term is small and stationary for the four countries under analysis

are demeaned.

$$z_t = A(L)z_{t-1} + \epsilon_t$$

where ϵ_t is a vector of zero mean errors. The VAR has the following first order companion representation:

$$Z_t = \bar{A}Z_{t-1} + \bar{\epsilon}_t$$

where $Z_t = (z_t^{'}, ..., z_{t-p+1}^{'})$ and $\bar{\epsilon}_t = (\epsilon_t, 0)$. Next, I define the vectors $e_r, e_{\Delta nx}, e_{nxa}$ such that they select the different elements of Z_t (for example $e_r^{'}Z_t = r_t^{NFA}$). I can express equation (4) in terms of the VAR formulation.

$$e_{nxa}^{'}Z_t = -(e_r^{'} + e_{\Delta nx}^{'})\sum_{i=1}^{\infty}\rho^i E_t Z_{t+i}$$

The valuation and trade components can be computed as follow:

$$nxa_t^r = e_r^{'}\rho\bar{A}(I - \rho\bar{A})^{-1}Z_t = \sum_{i=1}^{\infty}\rho^i\bar{A}^i E(r_{t+i}^{NFA}|\Omega_t^*)$$

$$nxa_t^{\Delta nx} = e_{\Delta nx}^{'}\rho\bar{A}(I - \rho\bar{A})^{-1}Z_t = \sum_{i=1}^{\infty}\rho^i\bar{A}^i E(\Delta nx_{t+i}|\Omega_t^*)$$

In the next sections I will exploit the relations derived from the present value equation (3.4) for the joint dynamics of r_t^{NFA}, Δnx_t, and nxa_t, as well as the estimates of the valuation and trade components to analyze the external adjustment process of France, Germany, Italy and Spain.

3.3.1 Testing for Structural Breaks

First of all I am going to test if we can identify any changes in the behaviour of the variables included in the VAR specification at the time of the introduction of the euro. I will do so by running structural break tests at unknown dates for a system of equations using the VAR developed in the previous section. The results of the tests will provide evidence in favour or against the potential role that the foreign exchange rate regime may have on the external adjustment process. Qu and Perron (2007) provide a framework to analyze series with multiple structural changes that occur at unknown dates in linear multivariate regression models, such as VARs. The breaks may happen in the parameters of the conditional mean, in the covariance matrix of the errors, or both, and the distribution of the regressors is also allowed to change across regimes. This is important because the tests determine whether or not the breaks in mean and variance happen at the same time. The framework used by these authors is the following and it is also explained with more detail in Section 2.5.

$$y_t = (I \otimes z_t')S\beta_t + u_t$$

When using a VAR model as in this case we have that $z_t = (y_{t-1}, ..., y_{t-q})$, which contains the lagged dependent variables. I use a VAR(1) following the results from the Akaike and the Schwarz criteria that select the optimal number of lags.

In order to construct the test of the null hypothesis of no break versus the alternative hypothesis of some unknown number of breaks I use the $UDmaxLRT(M)$ and $WDmaxLRT(M)$ double maximum tests to see if at least one break is present. Then, if the test rejects this hypothesis, I consider a $SEQ_T(l + 1|l)$ sequential procedure obtained from a global maximization of the likelihood function and based on a test of l versus $l + 1$ changes.[12].

Table 3.2 shows the results for France. The test identifies a structural break in the behaviour of the series that happen at the end of 1998. This is consistent with the introduction of the euro having modified the behaviour of the net external position and the adjustment process, potentially changing the relevance of the valuation and trade components as well. The test identifies another two breaks for France, the next one in 2004 and the last one in 2009. These two breaks seem to be more related to the real economy although the first one is more difficult to identify. After 2004 France began to experience negative current account and trade balances, which may have crucially affected the external adjustment process. The last break in 2009 should be related to the global financial crisis and the recession France suffered over that time. The global financial crisis produced important disruptions both on the financial and the real side of the economy and it is expected that these effects could have affected the adjustment process both for the valuation and trade components.

Table 3.3 presents the results for Italy. In this case the test only identifies two breaks, one in 1992 and another one in 1999. Similarly to France there is a structural break at the time of the introduction of the euro, providing further evidence on the change in the behaviour of the external imbalance due to the establishment of the common currency area. The break in 1992 could be related to another event affecting the nominal exchange rate as the Italian lira was devaluated by 7% in September of 1992 and abandoned the exchange rate

[12] I carried out the procedure with a maximum number of breaks $m = 3$ and a trimming of 0.2, which means that the minimal length required is 50 observations.

Table 3.2: France: Analysis of structural breaks (Qu-Perron test)

Wd_{max}	Sequential test (l+1/l) l=1	l=2	Number of breaks	
58.578***	30.565***	36.170***	3	
	Date		CI(95%)	
Break I	1998:IV		1998:I	2001:III
Break II	2004:I		2003:I	2004:II
Break III	2009:II		2008:III	2010:IV

Note: Maximun number of breaks M=3 and trimming = 0.2; The covariance matrix of the error is allowed to change and normality is assumed when testing for changes in the covariance matrix; Serial correlation in the residual and robust covariance matrix is constructed by the method of Andrews (1991); No pre whitenning technique is applied; *,** and *** denote significance at the 10%, 5% and 1% levels, respectively.

mechanism (ERM) of the European Monetary System at that time[13] . After this devaluation the Italian economy experienced a large period of current account and trade surpluses.

Table 3.4 shows the result of the structural break test for Spain. There are three structural breaks identified: one in 1993, another one in 1999 and the last one in 2007. The test identifies again a structural break at the time on the inception of the euro. It identifies another break in 1993 which, similarly to the case of Italy, should be related to events affecting the exchange rate. Even though Spain did not abandon the ERM in 1992, the currency disruptions in the European monetary system did also affect Spain, as the Spanish government devalued the peseta by 5% in September of 1992. After that there were another two devaluations during 1992 and 1993: a 6% devaluation in November of 1992 and a 8% devaluation in May of 1993. This period do also coincide with a recession of the Spanish economy in 1993, with the GDP growth reaching -1% that year.

Finally, Table 3.5 shows the results for Germany. The test identifies two structural breaks, one in 1989 and another one in 2006. The case for Germany is relevant as it is the only country that does not show a structural break at the time

[13]The exchange rate mechanism established that currency fluctuations had to be contained within a margin of 2.25% on either side of the bilateral rates (with the exception of the Italian lira, the Spanish peseta, the Portuguese escudo and the pound sterling, which were allowed to fluctuate by ±6%). The United Kingdom did also abandon the exchange rate mechanism in 1992.

Table 3.3: Italy: Analysis of structural breaks (Qu-Perron test)

	Sequential test (l+1/l)		
Wd_{max}	l=1	l=2	Number of breaks
129.679***	68.714***	25.019	2

	Date	CI(95%)	
Break I	1992:II	1992:I	1994:II
Break II	1999:IV	1995:III	2000:I

Note: Maximun number of breaks M=3 and trimming = 0.2; The covariance matrix of the error is allowed to change and normality is assumed when testing for changes in the covariance matrix; Serial correlation in the residual and robust covariance matrix is constructed by the method of Andrews (1991); No pre whitenning technique is applied; *,** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 3.4: Spain: Analysis of structural breaks (Qu-Perron test)

	Sequential test (l+1/l)		
Wd_{max}	l=1	l=2	Number of breaks
88.711***	36.509***	29.914*	3

	Date	CI(95%)	
Break I	1993:I	1992:I	1994:I
Break II	1999:II	1998:II	1999:III
Break III	2007:IV	2007:I	2010:I

Note: Maximun number of breaks M=3 and trimming = 0.2; The covariance matrix of the error is allowed to change and normality is assumed when testing for changes in the covariance matrix; Serial correlation in the residual and robust covariance matrix is constructed by the method of Andrews (1991); No pre whitenning technique is applied; *,** and *** denote significance at the 10%, 5% and 1% levels, respectively.

of the introduction of the euro. There could be several reasons. First, we have to consider that Germany's external imbalance can almost be completely explained by the trade component, a result that will be documented in the next section. Fuertes (2019) showed that the break in the US external position documented

Table 3.5: Germany: Analysis of structural breaks (Qu-Perron test)

	Sequential test (l+1/l)		
Wd_{max}	l=1	l=2	Number of breaks
75.006***	35.081***	25.623	2

	Date	CI(95%)	
Break I	1989:II	1987:II	1990:III
Break II	2006:III	2005:II	2006:IV

Note: Maximun number of breaks M=3 and trimming = 0.2; The covariance matrix of the error is allowed to change and normality is assumed when testing for changes in the covariance matrix; Serial correlation in the residual and robust covariance matrix is constructed by the method of Andrews (1991); No pre whitenning technique is applied; *,** and *** denote significance at the 10%, 5% and 1% levels, respectively.

at the end of fixed exchange rate regime was mainly driven by the valuation component. It could be that Germany's net external position was not affected by the introduction of the euro as much as the ones from the other countries because the trade component almost completely explains the behaviour of Germany's external imbalance. Second, Germany is the largest economy within the euro area and it is reasonable to think that the euro has been behaving more similarly to the Deutsche mark than any other currency and this may have produced a less impact on the external position. Moreover, the monetary policy of the euro zone has also been implemented to a large extent according to needs of the German economy, specially before the global financial crisis, which may have reduced the impact of the common currency. Germany's external imbalance seems to have been more affected by the reunification of the country in 1989 and by the global financial crisis. Both events are detected as structural breaks in the test although the one related with the global financial is stablished a little bit early at the end of 2006.

3.3.2 Valuation and Trade Effects

The results of the tests in the previous section show that the introduction of the common currency did change the external adjustment process, at least for France, ItaIy and Spain. Now I will use the estimates of the valuation and trade components in order to quantify the contribution of each of them to the variance of the net external position. By doing so with different sample periods I can assess how the external adjustment process have changed after the introduction of the common currency. In order to find out the contribution of the valuation and trade components to the external adjustment, I perform the following variance decomposition:

$$\begin{aligned} 1 =& \frac{Cov(nxa, nxa)}{Var(nxa)} = \frac{Cov(nxa^r, nxa)}{Var(nxa)} + \frac{Cov(nxa^{\Delta nx}, nxa)}{Var(nxa)} \\ =& \beta_r + \beta_{\Delta nx} \end{aligned} \tag{3.5}$$

The regression coefficients β_r and $\beta_{\Delta nx}$ represent the share on the unconditional variance of nxa explained by the valuation component nxa^r and the trade component $nxa^{\Delta nx}$. I can empirically estimate nxa, the valuation and trade components as well as the regression coefficients β_r and $\beta_{\Delta nx}$ using the VAR estimates. Let $\hat{A}$ denote the estimated companion matrix from the VAR. The predicted value for the nxa_t based on our VAR estimates will be:

$$\begin{aligned} \widehat{nxa}_t &= -(e_r^{'} + e_{\Delta nx}^{'})\rho\hat{A}(I - \rho\hat{A})^{-1}Z_t \\ &= \widehat{nxa_t^r} + \widehat{nxa_t^{\Delta nx}} \end{aligned} \tag{3.6}$$

From the OLS regressions of $\widehat{nxa_t^r}$ and $\widehat{nxa_t^{\Delta nx}}$ on nxa_t, I can compute the variance contribution of the estimated valuation and trade components. From this variance decomposition of the net external position we can obtain the relative importance of the valuation and trade components over the external adjustment process for each of the countries under analysis. Table 3.6 shows this information for the period including both the years before and after the introduction of the euro. For Germany and Spain the trade component has been more important for the external adjustment. For France, the relevance of the valuation and trade components has been almost the same and for Italy the valuation component has been capable to explain a larger share of the variance of the net external position. We have to keep in mind that the results are not completely comparable as the sample period is not exactly the same due to data availability. The results for Germany are striking as the trade component almost explains all the historical variance of the external position, being the contribution of the valuation component negligible. Moreover, the valuation component for Germany has moved in the opposite direction of the external imbalance, showing a negative covariance. For France, Italy and Spain both the valuation and the trade components have moved in the same direction as the external position. From these results we have to expect that if the behaviour of Germany's external imbalance remains similar to its historical trends, the reduction of its creditor position will come from a reduction in net exports. On the other hand, France, Italy and Spain will reduce their debtor positions by a combination of increasing net exports and positive return differentials, being the relative important of these two forces different for each country. As I already mentioned, Spain will restore its balanced position mainly through increasing net exports and Italy by positive return differentials. For France both components of external adjustment will play a similar role.

Table 3.6: Unconditional variance decomposition of net external position: Whole Sample

Country	Sample	Valuation Component	Trade Component
France	1990 - 2016	50.81	49.18
Germany	1980 - 2016	-1.67	101.66
Italy	1980 - 2016	56.32	43.67
Spain	1985 - 2016	39.06	60.93

Note: The unconditional variance decomposition of nxa is obtained from the coefficients β_r and $\beta_{\Delta nx}$ of OLS regression of $\widehat{nxa_t^r}$ and $\widehat{nxa_t^{\Delta nx}}$ on nxa

Next I analyze the changes that the introduction of the euro may have induced into the external adjustment process. Fuertes (2019) finds for the US that the valuation component increased its relative importance after the end of the Bretton Woods system of fixed exchange rate in 1973. A floating exchange rate regime made the valuation channel to play a more prominent role on the external adjustment process. With a floating exchange rate the valuation component not only was affected by asset price changes but also by exchange rate changes, adding an additional source of adjustment. Under the same rationale, the valuation component may have decreased its relative importance in the external adjustment process of the euro area countries once the euro was in place as the bilateral external portfolio positions among the countries of the union would only change due to asset price movements. In any case, the Bretton Woods system is not completely equivalent to the introduction of the euro as the change for the US was from a fixed to a floating exchange rate system while euro area countries remain with a floating exchange rates against third currencies. We have also to take into account that there have been other events that may have affected the relative importance of the valuation and trade channels. For instance, the global financial crisis triggered large asset price changes that may have affected the dynamics of the external adjustment, increasing the role of valuation effects.

Table 3.7 shows the variance decomposition of the net external position between the valuation and trade components since 1999. The results show that for Germany and Spain there is an increase in the importance of the trade component over this period. For Spain, since the introduction of the common currency, 80% of the variance of the external imbalance is explained by the trade component, being this number 61% if we use the whole sample. After the introduction of the common currency Spain will have to rely more on the trade channel in order to restore its debtor position. Similarly, for Germany the introduction of the euro has made the country to depend even more on decreases in net exports to reduce its creditor position. The valuation channel has increased its negative covariance with Germany's external imbalance during this period, making even more difficult the future external adjustment of its creditor position. France and Italy on the contrary have experienced an increase in the percentage of the variance of its external imbalance explained by the valuation component during the currency area period. This could be the result of larger asset price changes or that exchange rate movements within the euro area countries before the introduction of the euro were against the adjustment of the external positions of France and Italy, making the common currency to facilitate the adjustment of the external imbalance.

Table 3.7: Unconditional variance decomposition of net external position: Euro Period

Country	Sample	Valuation Component	Trade Component
France	1999 - 2016	54.60	45.39
Germany	1999 - 2016	-21.86	121.85
Italy	1999 - 2016	65.87	34.12
Spain	1999 - 2016	19.48	80.51

Note: The unconditional variance decomposition of nxa is obtained from the coefficients β_r and $\beta_{\Delta nx}$ of OLS regression of $\widehat{nxa_t^r}$ and $\widehat{nxa_t^{\Delta nx}}$ on nxa

Even though the results on Table 3.6 and Table 3.7 show that the contribution of the valuation and trade components have indeed changed since 1999, those changes can be related to other factors not affected by the foreign exchange regime. In order to identify, at least to some extent, the contribution of the exchange rate regime to the external adjustment process I have calculated a *exchange rate valuation component* and a *exchange rate trade component*. I use a trade weighted and financial weighted real exchange rates[14] to obtain the part of the return differentials and the net exports growth that is contemporaneously related to these two real exchange rates. Then I include these exchange rate variables in the VAR specification and compute the *exchange rate trade and valuation components*. These two components will be used to compute the percentage of the variance of nxa that is explained by the part of the valuation and trade components contemporaneously related to the real exchange rate.

Table 3.8 and Table 3.9 present the variance of nxa explained by the *exchange rate valuation component* and a *exchange rate trade component* before and after the introduction of the euro[15]. The most important conclusions from these two tables are that the exchange rates do contribute to the valuation and trade components of external adjustment and also that after 1999 those contributions have changed. We should also notice that the *exchange rate valuation component* has more relevance in the external adjustment process than the *exchange rate trade component* , consistent with the fact that the exchange rate may affect net exports with some time lags[16].

Table 3.8: Unconditional variance decomposition of net external position: FX contribution before 1999

Country	Sample	FX Valuation Component	FX Trade Component
France	1990 - 2016	-5.71	3.37
Germany	1980 - 1998	15.56	-2.95
Italy	1980 - 1998	15.27	3.01
Spain	1985 - 1998	11.28	11.02

Note: The numbers represent the unconditional variance of *nxa* explained by the part of the valuation and tread components that is contemporaneously related to the foreign exchange. Due to the small sample size, for France the figures are computed using the whole sample.

[14] The trade weighted exchange rates are OECD real effective exchange rates. I calculated the financial weighted real exchange rates using the country portfolio weights that I used to calculate the portfolio returns for each of the different asset classes.

[15] In the case of France in table 8, due to the small sample available before 1999 I provide the results for the whole sample instead

[16] Recall that I obtain the exchange rate components by including in the VAR estimation the part of the return differentials and net exports growth contemporaneously related with the trade weighted and financial weighted real exchange rates

Table 3.9: Unconditional variance decomposition of net external position: FX contribution after 1999

Country	Sample	FX Valuation Component	FX Trade Component
France	1999 - 2016	14.09	-20.06
Germany	1999 - 2016	15.63	2.33
Italy	1999 - 2016	3.77	-2.12
Spain	1999 - 2016	3.59	-6.49

Note: The numbers represent the unconditional variance of *nxa* explained by the part of the valuation and tread components that is contemporaneously related to the foreign exchange.

For Spain and Italy there has been a large decrease in the variance of nxa explained by the *exchange rate valuation component* after the introduction of the euro. In the case of the *exchange rate trade component* , it has negatively affected the external adjustment process after 1999 in both cases. We can then conclude that for these two countries the common currency area has implied a less important role of the exchange rate in the external adjustment and the need to rely in other mechanisms to restore the external balance. For Germany, consistent with the tests of structural breaks that do not find any break in 1999, it seems that there are not important changes on the contribution of the exchange rate components between the two periods. For France, the most striking result is the large and negative contribution of the *exchange rate trade component* during the euro period. Overall it is evident that the reliance on the exchange rate as a tool to facilitate the external adjustment process has largely diminished after the introduction of the euro.

3.3.3 Future Adjustment Path

We can also make an assessment of the future adjustment paths of the external positions for each country by computing the future expected values of nxa and the valuation and trade components. These paths should be consistent with the relative relevance of the valuation and trade components for each country. We can also learn how long will take to restore the external balance for each of the economies from their current debtor or creditor positions. We can compute the future expected adjustment path for nxa using the following equation:

$$E_T nxa_{T+k} = E_T \Delta^k nxa_{T+k} + nxa_T \tag{3.7}$$

We can also compute the future adjustment path of nxa if only the valuation or the trade components would operate:

$$E_T nxa^v_{T+k} = E_T \Delta^k nxa^v_{T+k} + nxa_T$$
$$E_T nxa^t_{T+k} = E_T \Delta^k nxa^t_{T+k} + nxa_T$$

Figure 3.4 shows the future adjustment path for Germany, being the horizontal axes the number of quarters ahead. The red line shows the future evolution of nxa while the blue and green lines show the evolution of nxa if only the valuation or the trade component would operate, respectively. As we have already documented previously almost all the adjustment will be made through the trade channel. The green line evolves very closely to the adjustment path for nxa. Given that the valuation component hinders the restoration of Germany's external balance, if the trade component would not play any role the external imbalance would result in a slightly larger creditor position than the current one, as the blue line shows. If there are not unexpected shocks affecting the future external adjustment, Germany will restore its balanced position in 40 years. The convergence process will be much faster over the first years, being able to reduce in half its creditor position in only 7 years.

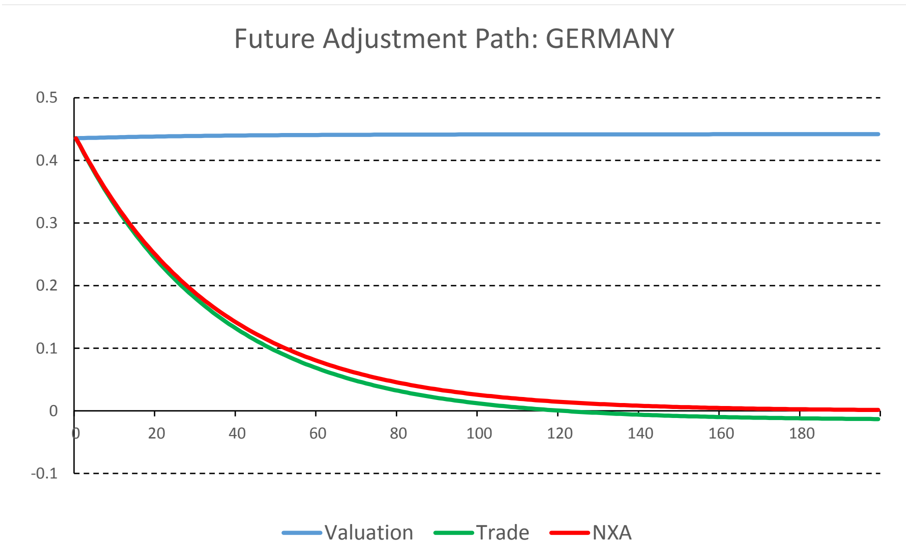

Figure 3.4: Germany: Future adjustment path

Figure 3.5 shows Spain's adjustment path. We can see again how it is consistent with previous results that showed how the trade channel is the main driver of the external adjustment. Spain would experience a fast convergence towards an external balanced position, taking around 19 years to reach that point. It would only take 3 years to reduce in half its debtor position.

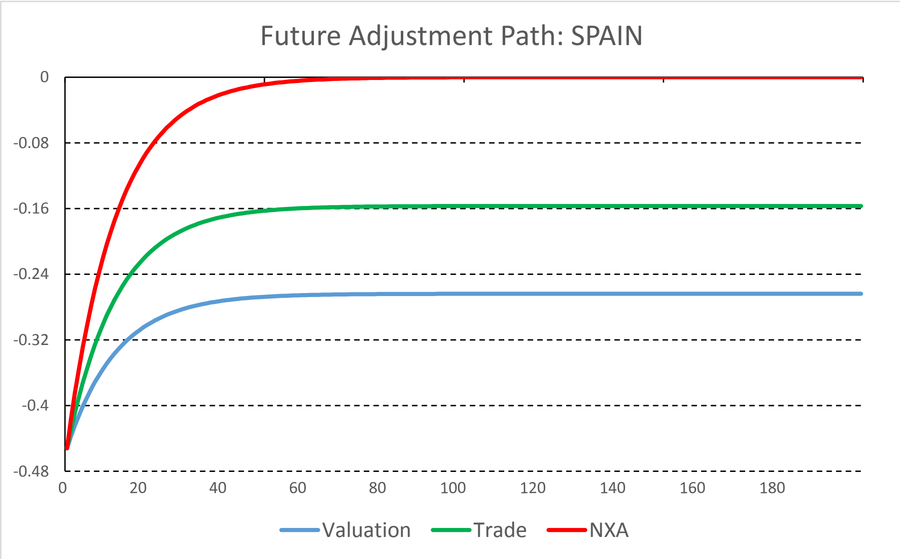

Figure 3.5: Spain: Future adjustment path

Figure 3.6 presents the adjustment path for France. In this case we can see how both the valuation and trade components almost contribute equally to the restoration of the external balance. For France it would take a long way to achieve the external balance although it is the country with the smallest external imbalance. It will restore its external balance in 25 years, being able to reduce it debtor position in half in 8 years.

Finally Figure 3.7 presents the future expected evolution of Italy's external position. The contribution of the valuation component to the external adjustment is larger than that of the trade component. Italy will restore the external balance in around 18 years and it will reduce it by half in less than 5 years[17].

It is reasonable to think that, as it has happened in the past, there would be unexpected shocks that will make the expected future adjustment paths depicted in charts above differ from the future evolution of the external imbalances. There is relevant information we can obtain from this exercise though. For the two

[17]The quick external adjustment expected for Italy and Spain is supported by projections from the International Monetary Fund released in the April 2019 World Economic Outlook. These projections establish that for a group of euro are debtor countries, including Italy and Spain, the net international investment position is expected to improve by more than 25 percentages points of their collective GDP over the period 2017-2024

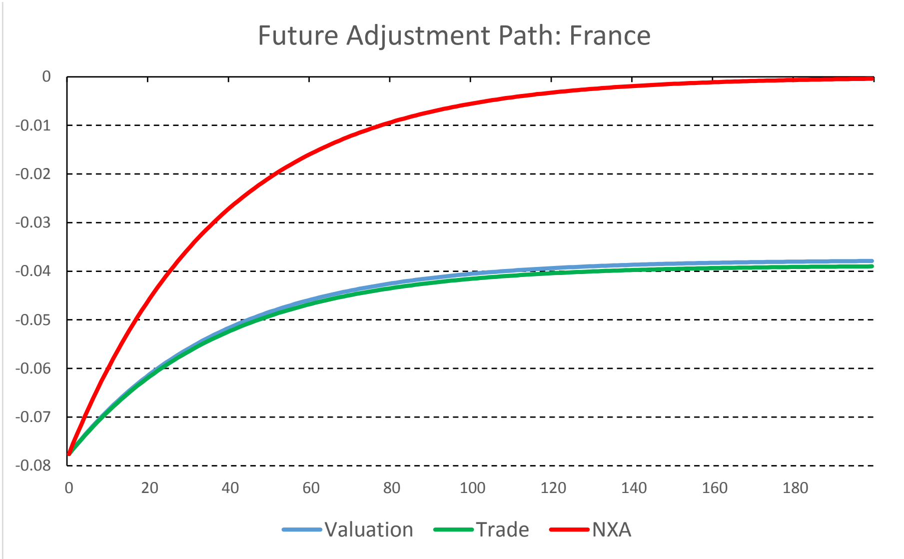

Figure 3.6: France: Future adjustment path

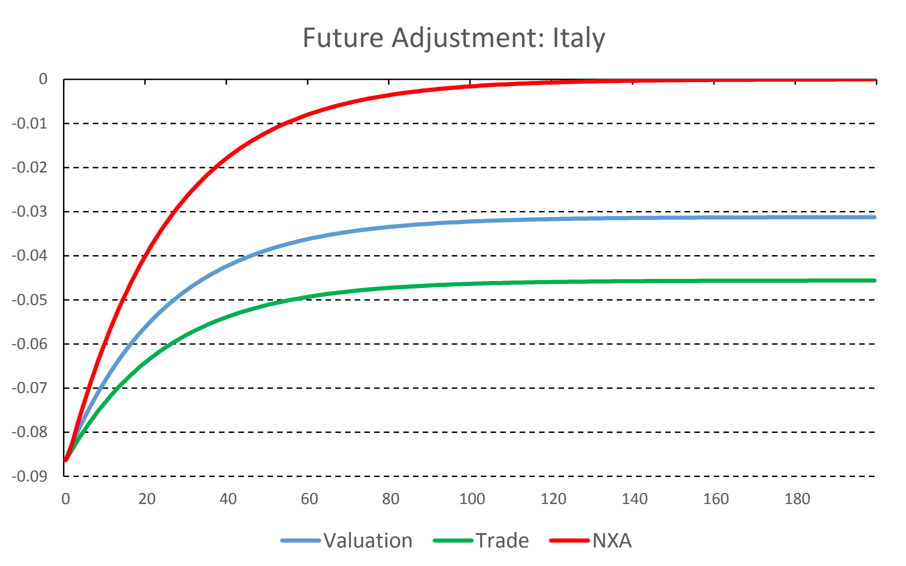

Figure 3.7: Italy: Future adjustment path

countries with the largest external imbalances, Germany and Spain, agents expect they will to be able to reduce their creditor and debtor positions by half in a relatively short period of time: 7 and 3 years respectively. The future adjustment paths also show how all countries but Germany will need both from the valuation and trade components to achieve their external balance. Only Germany could rely exclusively on the trade channel, with the valuation channel playing almost no role at all.

3.3.4 Exchange Rate Predictability

The results from previous sections document the relationship between the net external position and the exchange rate. It is then expected that the evolution of the external imbalance may have some forecasting power over the foreign exchange. This explanatory power has already been documented by Gourinchas and Rey (2007) and Evans and Fuertes (2011), although none of these papers study the implications of different exchange rates regimes. On the contrary, Fuertes (2019) do analyse the forecasting power of the net external position of the U.S. over the dollar, taking into account the foreign exchange regime. The results show that the relationship between the U.S. external imbalance and the dollar changes at the end of the Bretton Woods system of fixed exchange rates. I will next analyse if the inception of the euro had a similar effect. I do check whether the exchange rate regime influences the external adjustment process by regressing the changes in the real exchange rate on the net external position, a dummy variable identifying the exchange rate regime and an interaction term between the external position and the dummy. This interaction term will be the main variable of interest given that a statistical significant coefficient will imply a different relation between the foreign exchange and the net external position depending on the nominal foreign exchange regime. I compute the OLS estimates of

$$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \beta_2 FXd_t + \beta_3 nxa_t * FXd_t + \nu_{t+k} \tag{3.8}$$

for different horizons $k = \{1, 4, 8\}$. $\Delta^k e_{t+k}$ is the change in the real exchange rate (an increase implies an appreciation of the currency) and FXd_t is the dummy variable that identifies the foreign exchange regime (equals one before the introduction of the euro). I run the regressions separately for both the real trade weighted exchange rate and the real portfolio weighted exchange rate. For comparison purposes, I also compute the regression without the foreign exchange regime dummy and the interaction term.

Table 3.10 presents the results for Spain. The coefficient β_3 is significant both for the portfolio weighted and the trade weighted real exchange rates, implying that the inception of the euro affected the relationship between the net external position and the exchange rates. In particular, for the portfolio weighted real exchange rate, given that β_1 is not significant at any horizon in equation (3.8), we conclude that the forecasting power of nxa disappeared after 1999, consistent with the decreased role played by the exchange rate in the external adjustment process due to the common currency. As expected, the sign of the coefficients is positive, meaning that a deterioration in the external imbalance implies a future exchange rate depreciation. Finally, we should notice the large increase in the R^2 when we run the regression taking into account the different exchange rate regime. The R^2 increases with the exchange rate horizon, reaching a value of 0.26 when forecasting the evolution of the exchange rate over the next two years.

Table 3.10: Spain: Forecasting exchange rates with the net external position.

	$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \nu_{t+k}$ (1)			$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \beta_2 FXd_t$ $+\beta_3(nxa_t * FXd_t) + \nu_{t+k}$ (2)		
	Trade Weighted			**Trade Weighted**		
Horizon	1	4	8	1	4	8
β_1	0.0098	0.0198***	0.0219***	0.0014	0.0128*	0.0165***
	(0.0116)	(0.0052)	(0.0041)	(0.0160)	(0.0071)	(0.0064)
β_3				0.0153	0.0163	0.0168*
				(0.0248)	(0.0120)	(0.0094)
R^2	0.0071	0.0862	0.1749	0.0120	0.1166	0.2619
	Portfolio Weighted			**Portfolio Weighted**		
Horizon	1	4	8	1	4	8
β_1	0.0117	0.0174***	0.0184***	-0.0039	-0.0008	0.0068
	(0.0135)	(0.0063)	(0.0043)	(0.0192)	(0.0077)	(0.0064)
β_3				0.0282	0.0340***	0.0274***
				(0.0282)	(0.0124)	(0.0088)
R^2	0.0073	0.0603	0.1205	0.0187	0.1328	0.2675

Note: Left (right) hand panel shows the results of the regression 1 (2). $\Delta^k e_{t+k}$ is the rate change of the dollar for different horizons $k = 1, 4, 8$. FXd_t is a dummy variable equal to 0 if there is a fixed exchange rate regime. nxa_t is the net external position. Standard errors in parenthesis.*,** and *** denote significance at the 10%, 5% and 1% levels, respectively

The results for Italy are presented on Table 3.11. They are very similar to those obtained for Spain although there is an important difference. The external imbalance has a less forecasting power for the trade weighted real exchange rate than for the portfolio weighted one. This could be consistent with the fact that for Italy the valuation component has more relevance than the trade component. The R^2 for the evolution of the portfolio weighted real exchange rate over the next two years reaches 0.36 in the regression that takes into account the change in the foreign exchange regime. As it happened with Spain, the forecasting power of nxa over the portfolio weighted exchange rate disappears after the introduction of the euro.

Table 3.11: Italy: Forecasting exchange rates with the net external position.

	$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \nu_{t+k}$ (1)			$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \beta_2 FXd_t$ $+\beta_3(nxa_t * FXd_t) + \nu_{t+k}$ (2)		
	Trade Weighted			**Trade Weighted**		
Horizon	1	4	8	1	4	8
β_1	0.0070	0.0196	0.0241***	-0.0042	0.0126	0.0232**
	(0.0225)	(0.0141)	(0.0087)	(0.0188)	(0.0128)	(0.0098)
β_3				0.0176	0.0106	0.0013
				(0.0347)	(0.0232)	(0.0151)
R^2	0.0012	0.0241	0.0708	0.0035	0.0269	0.0710
	Portfolio Weighted			**Portfolio Weighted**		
Horizon	1	4	8	1	4	8
β_1	0.0378	0.0404***	0.0397***	-0.0020	0.0021	0.0071
	(0.0242)	(0.0147)	(0.0092)	(0.0096)	(0.0067)	(0.0065)
β_3				0.0554	0.0526**	0.0444***
				(0.0376)	(0.0213)	(0.0130)
R^2	0.0237	0.0872	0.1621	0.0560	0.1925	0.3605

Note: Left (right) hand panel shows the results of the regression 1 (2). $\Delta^k e_{t+k}$ is the rate change of the dollar for different horizons $k = 1, 4, 8$. FXd_t is a dummy variable equal to 0 if there is a fixed exchange rate regime. nxa_t is the net external position. Standard errors in parenthesis.*,** and *** denote significance at the 10%, 5% and 1% levels, respectively

Table 3.12 shows the results for Germany. It is the country where the R^2 are lower, implying the weakest forecasting power of the external imbalance over the exchange rate among the four countries. The coefficient β_3 is only significant at the two year horizon and the regression forecasting the trade weighted real exchange rate provides more significant coefficients and a larger R^2, consistent with the trade component having a more important role in the external adjustment of this country. The main difference with respect to previous results is the negative sign of the coefficient β_1 in the regression that takes into account the foreign exchange regime. The negative coefficient implies that after 1999 an improvement of Germany's external imbalance forecasts a depreciation of the euro. This result provides interesting insights about the external adjustment process within a currency union. After 1999 the net external position of Italy and Spain deteriorated while Germany's one improved. We have documented for Italy and Spain, since 1999, that a deterioration of the external imbalance implied a future depreciation of the trade weighted real exchange rate. During the same period Germany improved its external imbalance, what required a future appreciation of the currency in order to facilitate the external adjustment. The negative sign of β_1 may indicate that the behaviour of the euro has been driven by the needs of external adjustment of deficit countries such as Italy and Spain, compromising the adjustment of Germany's external position as foreign exchange movements affect differently debtor and creditor countries.

Finally, Table 3.13 present the results for France. The β_3 coefficients are significant and the R^2 increases significantly when running the regressions taking into account the foreign exchange rate regime. The main difference with previous results is the negative coefficient β_3 , implying that before 1999 a deterioration in France's external imbalance forecasts an appreciation of the french franc. After the introduction of the euro the forecasting power of nxa shows the expected relationship as β_3 coefficients are positive.

The results from tables 10 - 13 provide two important messages. First, the relationship between the external imbalance and the future evolution of exchange rates is affected by the foreign exchange regime. Second, this relationship could be different for each country within a currency union, helping or jeopardising the external adjustment process depending on holding a debtor or a creditor position.

Table 3.12: Germany: Forecasting exchange rates with the net external position.

	$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \nu_{t+k}$ (1)			$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \beta_2 FXd_t + \beta_3(nxa_t * FXd_t) + \nu_{t+k}$ (2)		
	Trade Weighted			**Trade Weighted**		
Horizon	1	4	8	1	4	8
β_1	-0.0012	0.0054	0.0075**	-0.0100	-0.0038	-0.0232**
	(0.0107)	(0.0056)	(0.0035)	(0.0188)	(0.0128)	(0.0082)
β_3				0.0091	0.0096	0.0359***
				(0.0247)	(0.0136)	(0.0092)
R^2	0.0001	0.0052	0.0209	0.0070	0.0136	0.0826
	Portfolio Weighted			**Portfolio Weighted**		
Horizon	1	4	8	1	4	8
β_1	0.0102	0.0102*	0.0108**	0.0077	0.0086	-0.0025
	(0.0147)	(0.0060)	(0.0043)	(0.0147)	(0.0082)	(0.0067)
β_3				0.0026	0.0012	0.0158*
				(0.0243)	(0.0113)	(0.086)
R^2	0.0040	0.0161	0.0325	0.0043	0.0173	0.0412

Note: Left (right) hand panel shows the results of the regression 1 (2). $\Delta^k e_{t+k}$ is the rate change of the dollar for different horizons $k = 1, 4, 8$. FXd_t is a dummy variable equal to 0 if there is a fixed exchange rate regime. nxa_t is the net external position. Standard errors in parenthesis.*,** and *** denote significance at the 10%, 5% and 1% levels, respectively

Table 3.13: France: Forecasting exchange rates with the net external position.

	$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \nu_{t+k}$ (1)			$\frac{1}{k}\Delta^k e_{t+k} = \alpha + \beta_1 nxa_t + \beta_2 FXd_t + \beta_3(nxa_t * FXd_t) + \nu_{t+k}$ (2)		
	Trade Weighted			**Trade Weighted**		
Horizon	1	4	8	1	4	8
β_1	-0.0082	0.0075	0.0009	0.0282	0.0303**	0.0334***
	(0.0138)	(0.0084)	(0.0060)	(0.0184)	(0.0146)	(0.0095)
β_3				-0.0364	-0.0374*	-0.0567***
				(0.0314)	(0.0198)	(0.0113)
R^2	0.0042	0.0089	0.0003	0.0221	0.0669	0.2673
	Portfolio Weighted			**Portfolio Weighted**		
Horizon	1	4	8	1	4	8
β_1	-0.0030	-0.0066	-0.0102***	0.0055	0.0078	0.0095*
	(0.0098)	(0.0055)	(0.0037)	(0.0149)	(0.0086)	(0.0058)
β_3				-0.0192	-0.0285**	-0.0388***
				(0.0243)	(0.0129)	(0.0069)
R^2	0.0006	0.0123	0.0687	0.0059	0.0599	0.2746

Note: Left (right) hand panel shows the results of the regression 1 (2). $\Delta^k e_{t+k}$ is the rate change of the dollar for different horizons $k = 1, 4, 8$. FXd_t is a dummy variable equal to 0 if there is a fixed exchange rate regime. nxa_t is the net external position. Standard errors in parenthesis.*,** and *** denote significance at the 10%, 5% and 1% levels, respectively

3.4 Robustness Checks

The accuracy in estimating portfolio returns has been a topic of ample debate in the literature. In the case of the U.S. a first wave of studies calculated portfolio returns implied from U.S. NIIP data (see Lane and Milesi-Ferretti (2005); Meissner and Taylor (2006) and Obstfeld and Rogoff (2005)), obtaining large return differentials between portfolio assets and liabilities. Later, Curcuru et al (2008) argued that these implied returns were upward biased due to inconsistencies in the different sources of data for flows and positions. They calculate portfolio returns from market prices, as Gourinchas and Rey (2007) do, obtaining smaller return differentials. Recent research from the BEA, the compilers of the NIIP data, does also find lower estimates of portfolio return differentials than those obtained from the implied returns in the first wave of papers, pointing out that NIIP data should not be used to obtain returns (see Gohrband and Howell (2015)).

In this paper I computed returns from market prices in order to obtain quarterly return differentials for a period that includes both the years before and after the introduction of the euro. I do not claim that the implied returns may have any inconsistencies for the countries under analysis[18] as it is the case for the U.S., but I needed to construct a data set that includes the period before the introduction of the euro. Unfortunately I could not obtain quarterly implied returns for the yeas before 1999 due to data limitations and the only option was to estimate returns from market prices.

Then, a natural robustness check is to compute the implied returns for the years avaialble and compare the approximation accuracy of our different estimates using the market based returns and the implied ones. I will also assess if the main results and conclusions change when using implied returns. We have already showed that the estimates of the valuation and the trade component together are capable to explain the whole variance of the actual nxa. This is a first proof of the quality of our approximation for the present value equation (3.4). Another way to asses the accuracy of our approximation is to compute the mean square error of the difference between the actual nxa and the predicted $\widehat{nxa}_t$, which is obtained as the sum of the estimates of the valuation and trade components. Finally, we can also assess the accuracy of the estimates by checking if the present value equation (3.4) holds using the forecasts from the VAR. In order to do we first

[18] Habib (2010) analyses the differential returns between gross foreign assets and liabilities for a sample of 49 countries, including France, Germany, Italy and Spain, using yearly implied returns

obtain the following expression from the present value equation (3.4):

$$
\begin{aligned}
e'_{nxa} Z_t &= -\,(e'_r + e'_{\Delta nx}) \sum_{i=1}^{\infty} \rho^i A^i Z_t \\
&= -\,(e'_r + e'_{\Delta nx}) \rho A (I - \rho A)^{-1} Z_t
\end{aligned}
\tag{3.9}
$$

This equation must hold for all possible values of Z_t, such that the companion matrix A from the VAR must satisfy

$$
e'_{nxa} = -\,(e'_r + e'_{\Delta nx}) \rho A (I - \rho A)^{-1} \tag{3.10}
$$

The equation above includes a set of restrictions on the coefficients of the VAR that represent constraints on the joint dynamics of r_t^{NFA}, Δnx_t, and nxa_t. They can be empirically examined by computing a Wald test from the estimates of the A matrix obtained as the OLS estimates of the VAR equations.

Table 3.14 present the results of the Wald test on the above equation as well as the mean square errors of the predicted $\widehat{nxa}_t$ using the market based derived returns (DR) and the implied returns (IR). For Germany, Italy and Spain the Wald test shows that using the implied returns we cannot reject the null that equation (3.10) holds. On the contrary, the Wald test rejects the null when using the market based returns. We should keep in mind that the mean square errors of $\widehat{nxa}_t$ are very low using either market based returns and derived returns. The results of the Wald test indicate that the market based returns may have incurred in some inconsistencies that may reduce the accuracy of our estimates of the valuation and trade component, being the implied returns more accurate to describe the joint behaviour of r_t^{NFA}, Δnx_t, and nxa_t. For the case of France the Wald test rejects the null that equation (3.10) holds, with the MSE being larger for the predicted $\widehat{nxa}_t$ when using the implied returns. In this case it seems that the market based returns are more accurate. We should keep in mind that even though the Wald test rejects that equation (3.10) holds when using the market based returns, the estimates of the valuation and trade component obtained produce very low approximation errors and they are capable to explain the whole variance of the actual nxa.

Because of that and despite the fact that the market based returns show some degree of inconsistencies for Germany, Italy and Spain, our main concern is to asses if those inconsistencies spotted out in the results of the Wald tests are large enough to invalidate the conclusions documented in the previous sections.

Table 3.14: Especification test and approximation error

Country		Sample	Wald Test (p-value)	MSE
France				
	DR	1999 - 2016	0.0084	3.86E-05
	IR	999 - 2016	0.0000	9.00E-05
Germany				
	DR	2004 - 2016	0.0000	6.91E-05
	IR	2004 - 2016	0.9520	3.23E-07
Italy				
	DR	1999 - 2016	0.0000	1.62E-04
	IR	1999 - 2016	0.1454	1.90E-06
Spain				
	DR	1999 - 2016	0.0000	4.89E-04
	IR	1999 - 2016	0.7266	1.04E-06

Note: The table shows the results of a Wald test on $e'_{nxa} = -(e'_r + e'_{\Delta nx})\rho A(I - \rho A)^{-1}$, which asseses if the present value relation of equation (3.4) holds: and the mean square approximation error of $\widehat{nxa}$, using the derived returns (DR) and the implied returns (IR).

In particular we should be concerned about the capability of the valuation and trade components to accurately portrait the behaviour of the net external position. Given that we have already showed that using the implied returns we obtain estimates of the valuation and trade components that provide a good approximation of the present value equation (3.4), we next evaluate how different these estimates are when using the market based return.

Table 3.15 shows the correlation coefficients for different series obtained using market based returns and derived returns. The first two columns show the correlation of the estimates of the valuation and trade components obtained using the different return differentials. The correlation coefficients are very close to one, signalling that the behaviour of the series is almost the same no matter the returns used. The third column assess the correlation between the predicted $\widehat{nxa}_t$ using the two different series of return differentials, showing again that both are pretty similar. Finally, the last two column show the correlation between the actual nxa and the predicted $\widehat{nxa}_t$ using the implied returns and the market based returns respectively. Even though the correlations are larger for the series computed using implied returns, except for France, the correlations are also high when using market base returns. By these metrics we can conclude that the analysis using market based returns remains valid.

Table 3.15: Correlations between series obtained using implied and derived returns

Country	Valuation Component	Trade Component	$\widehat{nxa}$	$nxa\|\widehat{nxa}_{IR}$	$nxa\|\widehat{nxa}_{DR}$
France	0.9633	0.9961	0.9813	0.9913	0.9959
Germany	0.9923	0.9957	0.9928	0.9999	0.9919
Italy	0.9669	0.9946	0.9904	0.9999	0.9888
Spain	0.9883	0.9912	0.9922	0.9999	0.9793

Note: The first (second) column represent the correlation between the estimated valuation component $\widehat{nxa}_t^r$ (estimated trade component $\widehat{nxa}_t^{\Delta nx}$) computed using the derived market based returns and the implied returns for the period when the latter are available. The third column shows the correlation between the predicted $\widehat{nxa}$ using the derived and implied returns. Finally, the two last columns show the correlation between the actual nxa and the predicted $\widehat{nxa}$ using implied returns and the derived market based returns respectively.

Finally, I have replicated the results from Table 3.7 using the two types of returns. Table Table 3.16 presents the percentage of the variance of nxa explained by the valuation and trade components computed using implied returns and market based returns. The results remain qualitatively the same no matter the series of return used. The relative relevance of the valuation and trade components do not change and the percentage of variance explained is almost the same independently of the returns used. The only country that shows some differences is Italy although the valuation component remains as the main channel of adjustment.

Overall, even though for Germany, Italy and Spain the implied returns are more accurate to describe the joint dynamics of r_t^{NFA}, Δnx_t, and nxa_t embedded in the present value equation (3.4), using the market based returns provides the same conclusions about the external adjustment process and the estimates of the valuation and trade components are almost the same. We can then be pretty comfortable with the results obtained in the previous sections.

Table 3.16: Unconditional variance decomposition of *nxa* explained by the exchange rate: derived returns vs. implied returns.

Country	Sample	FX Valuation Component	FX Trade Component
France	1999 - 2016	54.6 (58.8)	45.4 (41.2)
Germany	1999 - 2016	-21.9 (-23.6)	121.8 (123.6)
Italy	1999 - 2016	65.9 (51.2)	34.1 (48.8)
Spain	1999 - 2016	19.5 (16.2)	80.5 (83.8)

Note: The numbers represent the unconditional variance of *nxa* explained by the part of the valuation and trade components that is contemporaneously related to the exchange rate. The values in parenthesis show the resutls when using the implied returns.

3.5 Conclusion

The process of external adjustment for a country within a common currency area has received little attention in the literature, despite the fact that an important mechanism of correction of imbalances, the nominal exchange rate, has been partially cancelled. Changing from a floating to a fixed exchange rate regime within a currency area may difficult the external adjustment and could be potentially dangerous for countries with large negative external positions. Understanding how the external adjustment process has evolved over time for the countries of the euro area and the implications of the introduction of the euro are the main research questions of the paper.

I analyze the external adjustment path of the four main economies of the euro area, covering both the period before and after the introduction of the euro, to understand if the currency area affected their external adjustment process. I find a structural break in the net external position for all countries but Germany at the time of the introduction of the euro, pointing out that the inception of the common currency changed the external adjustment process. The fact that Germany does not show this structural break is consistent with the exchange rate regime mainly affecting the valuation channel of external adjustment, given that the variance of Germany's net external position is almost completely explained by the trade channel. The importance of the valuation component of external adjustment increases after the introduction of the euro for France and Italy, and decreases for Germany and Spain. Third I also find that France and Italy will adjust the net external position mainly through the valuation component of external adjustment, while Germany and Spain will restore their external balance mostly through the trade component.

The results of the paper continue the debate for policy analysis on the benefits of a fixed or a floating exchange rate regime to correct external imbalances. I document adverse valuation effects that difficult the correction of external imbalances for the case of Germany. Even though this should not be a matter of concern as Germany enjoys a creditor position and reaching the external balance should not be crucial, adverse valuation affects could be dangerous in other situations. For example, emerging countries with a relevant share of foreign currency liabilities and large debtor positions, could be affected by a local currency depreciation as it may trigger large valuation effects that further increase their debtor positions. The findings in this paper do also reveal the need to change the mechanisms of external adjustment once a common currency is in place. Being the nominal exchange rate fixed among the countries of the currency union, other adjustment mechanisms such as internal devaluation and the change in the relative price levels. may operate. It is also important to notice that being part of a currency union may hinder the external adjustment process of a country as the adjustment needs are different for debtor and creditor countries. For instance, as it is documented in this paper, the real exchange rate have evolved according to the adjusting needs of debtor countries such as Italy and Spain, pushing towards larger external positions of creditor countries such as Germany.

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Chapter 4

Forecasting Emerging Market Currencies: Are Inflation Expectations Useful?

(joint with Simón Sosvilla-Rivero)

4.1 Introduction

The past 50 years have been characterized by increasing internationalization of economic activity. The relentless advances that have taken place in areas such as transport and communications, together with the progressive liberalization of international economic relationships, have given rise to unprecedented increases in trade in goods and services as well as in financial assets.

This increase has gone hand in hand with the spectacular development that has been experienced in foreign exchange markets, since the use of different national currencies makes conversions from one to another a necessary aspect of each international transaction. Naturally, this puts what are universally known as 'foreign exchange markets' at the forefront as mechanisms of multilateral conversion.

The foreign exchange market is the world's most important financial market, both due to its daily trade volume as well as its incidence in the behaviour of other markets, both for financial assets and for goods and services. Average daily global turnover in in foreign exchange spot and OTC derivatives markets rose to 5.1 trillion dollars in April 2016, with several emerging market currencies progressively gaining market share (Bank for International Settlements, 2016).

Due to the extreme importance of foreign exchange markets for international economic activity, it is common to see in the financial market literature attempts to predict exchange rates. This has proven to be a most difficult task, due to the high volatility experienced by exchange markets, as well as the complex data-generating process governing its underlying dynamic behaviour (see, for example, Sarno and Taylor, 2002). Following on from the influential paper by Meese and Rogoff (1983) on the poor predictive capacity of exchange rate determination models compared to a random walk, there has been an immense amount of effort dedicated to analysing the causes of the extreme difficulties experienced when attempting to predict exchange rates, as well as attempts to design alternative procedures that offer improvements in predictions. Later, Cheung et al. (2005) evaluated the predictability of a wide variety of models that have been proposed over the past decade, and they conclude that these models are still unable to improve a random walk.

Sosvilla-Rivero and García (2005) use an Expectations Version of Relative Purchasing Power Parity (EVRPPP) to generate expected short-run variations in the dollar/euro exchange rate. With few exceptions, their predictors, based on the differential of inflation expectations derived from inflation-indexed bonds for the euro area and the USA, behave significantly better than a random walk.

This paper hopes to contribute to the wide and active research programme on predictability in financial markets by evaluating the empirical relevance of EVRPPP for the exchange rate of eight major emerging countries. The rest of the paper is organized as follows. Section 4.2 presents an overview of the theoretical framework used to generate the predictions. Section 4.3 describes the database used, and offers a statistical evaluation of the predictors. Section 4.4 examines the consistency properties of the formation process underlying the inflation expectations.Section 4.5 performs some robustness checks to assess if the uncovered rate parity condition could be useful in predicting the foreign exchange. Finally, Section 4.6 summarizes the findings and offers some concluding remarks.

4.2 Theoretical Framework

Following Sosvilla-Rivero and García (2005), we make use of the EVRPPP, that integrates the parity conditions of both commodity and financial markets. This version, known as the efficient market approach (see Roll, 1979), is based on Fisher's hypothesis and the assumption of uncovered interest rate parity.

Fisher's hypothesis postulates that a country's nominal interest rate should be equal to its real interest rate plus the expected rate of inflation. Therefore:

$$i = r + \pi^e \tag{4.1}$$

$$i^* = r^* + \pi^{*e} \tag{4.2}$$

where i is the nominal interest rate, r is the real interest rate, π is the expected rate of inflation, and an asterisk denotes a foreign variable. Uncovered interest rate parity requires that the nominal interest differential between a domestic currency investment and a foreign currency investment be equal to the expected change in the exchange rate:

$$\sigma^e = i - i^* \tag{4.3}$$

where σ^e is the expected rate of depreciation.

Since international investors are concerned with real rather than nominal returns on their financial assets, in order to maximize the real returns of their assets, they transfer capital from a low interest rate country to one with a higher real rate. Thus, in absence of transactions costs, specific asset risks and taxation, this process of arbitrage will result in the real rates of interest over the two countries being equated:

$$r = r^* \tag{4.4}$$

By substracting (4.2) from (4.1), using (4.3) and (4.4), and rearranging, we obtain:

$$\sigma^e = \pi^e - \pi^{*e} \tag{4.5}$$

which is the EVRPPP, in which all of the variables are expressed in expected values instead of incurrent values. In this way, given economic agents' expectations of the future rates of inflation in both the national and the foreign economies, we can derive a measure of market expectations on the future behaviour of the exchange rate which, compared to the rate actually observed at any given moment, will allow us to calculate the market's expected exchange rate for the following period:

$$S^e_{t+1} = (1 + \sigma^e)S_t \tag{4.6}$$

where S denotes the exchange rate (expressed as the number of units of local currency that are exchanged for one unit of foreign currency). Note that this exchange rate prediction generator process is based on market expectations of the future evolution of the inflation rates. In order to make it effective, we need to have proxy variables for the expected rates of inflation in the national and foreign economies. In this paper, in contrast with the generally accepted approach in the empirical literature in this area which consists of using observed values for inflation rates, or predictions for these rates based on univariate models, we use inflation expectations for emerging markets obtained using the affine model employed by Fuertes et al. (2018).

4.3 Data and empirical results

4.3.1 Data

We consider data for Brazil, Colombia, Chile, India, Mexico, Poland, South Africa, South Korea and Turkey. The data on exchange rates consist of monthly averages of daily figures against the US dollar series for the Brazilian Real (BRL), the Colombian Peso (COB), the Chilean Peso (CLP), the Indian Rupee (INR), the Mexican Peso (MXN), the Poland Zloty (PLN), the South African Rand (ZAR), the South Korean Won (KRW) and the Turkish Lira (TRY) offered by the Federal Reserve Economic Data (FRED), a database maintained by the Research division of the Federal Reserve Bank of St. Louis[1].

As for the inflation expectations, one common way of obtaining them is to use market prices of financial instruments used to hedge against inflation such as inflation-linked bonds, inflation swaps or inflation options. Unfortunately, there are not many markets of inflation-linked securities in emerging economies and because of that we have followed Fuertes et al. (2018) to calculate them[2]. They use

[1] https://fred.stlouisfed.org/

[2] For the case of the U.S. we have used inflation linked swaps to obtain inflation expectations as there is a depth and liquid market available for those securities. Even for some emerging countries such as Chile, where inflation-linked securities exists, it is not reliable to use them as a proxy for inflation expectations given that the low liquidity of the market introduces large

an affine model that takes as factors the observed inflation and the parameters generated in the zero-coupon yield curve estimation of nominal government bonds. The data on government bonds prices and inflation rates is obtained from IFS-DataStream.

Our sample spans from February 2007 to September 2017 for Brazil, from February 2005 to October 2017 for Colombia, from July 2012 to October 2017 for Chile, from February 2001 to April 2018 for India and Poland, from May 2001 to August 2018 for Mexico, from February 2001 to October 2018 for South Africa and South Korea, and from November 2007 to April 2018 for Turkey. The sample size has been conditioned by the availability of inflation-expectations data.

4.3.2 Forecasting Accuracy

Based on the inflation expectations for 1-, 5- and 10-year ahead, we compute exchange rate expectations using equation (4.5) and then, using equation (4.6), we compute recursive exchange rate forecasts that we denote EX1, EX5 and EX10, respectively[3]. Figure 4.1 and Figure 4.2 displays the observed and predicted exchange rates. As can be seen, the predicted exchange rates closely track the evolution of the observed exchange rates and the predicted values are very similar no matter the inflation expectations horizon used.

To formally evaluate the forecasting performance of the forecast accuracy, we fist consider the root mean square error (RMSE), the mean absolute percentage error (MAPE) and the Theil inequality coefficient (U). Suppose the forecast sample is $j = T+1, T+2, \ldots, T+k$, and denote the actual and forecasted value in period t as and , respectively. The RMSE statistic is computed as follows:

$$RMSE = \sqrt{\sum_{t=T+1}^{T+k} (\widehat{y}_t - y_t)^2 / k} \tag{4.7}$$

and the U statistic is computed as follows:

premiums (see Fuertes et al., 2018).

[3]Note that in equation (4.5) we are imposing that π^e and π^{*e} have the same coefficient (1), allowing us to combine them forming a differential in expected inflations. To assess the robustness of our results, we assumed that the coefficients are different, estimating the following equation:

$$\sigma^e = \alpha + \beta\pi^e - \beta^*\pi^{*e} + \epsilon_t$$

where ϵ_t is the error term, and where α is also introduce to capture the existence of some factors such as government control on prices, restrictions on international trade and transportation costs that could account for deviations from EVRPPP. The results (not shown here to save space, but they are available from the authors upon request.) render the same qualitative conclusions.

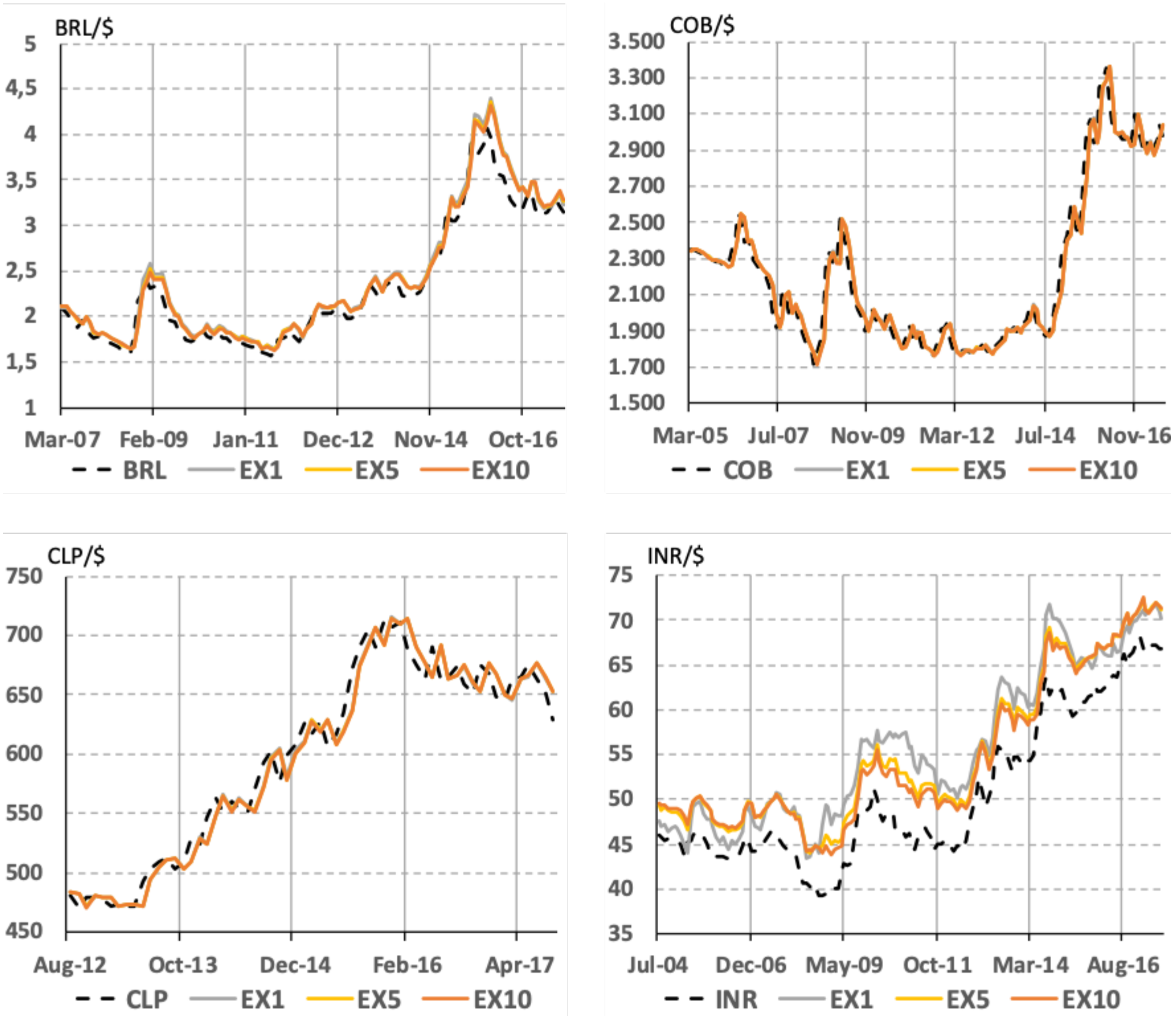

Figure 4.1: Observed and predicted exchange rates: Brasil, Colombia, Chile, India.

$$U = \frac{\sqrt{\sum_{t=T+1}^{T+k} (\widehat{y}_t - y_t)^2 / k}}{\sqrt{\sum_{t=T+1}^{T+k} \widehat{y_t}^2 / k} + \sqrt{\sum_{t=T+1}^{T+k} y_t^2 / k}} \tag{4.8}$$

As can be seen, these statistics all provide a measure of the distance of the true from the forecasted values. The RMSE statistics depend on the scale of the dependent variable (the smaller the error, the better the forecasting ability), while the Theil inequality coefficient is scale invariant (lying between zero and one, where zero indicates a perfect fit).

As for the MAPE, it is computed as follows:

$$MAPE = 100 \sum_{t=T+1}^{T+k} \left| \frac{\widehat{y}_t - y_t}{y_t} \right| / k \tag{4.9}$$

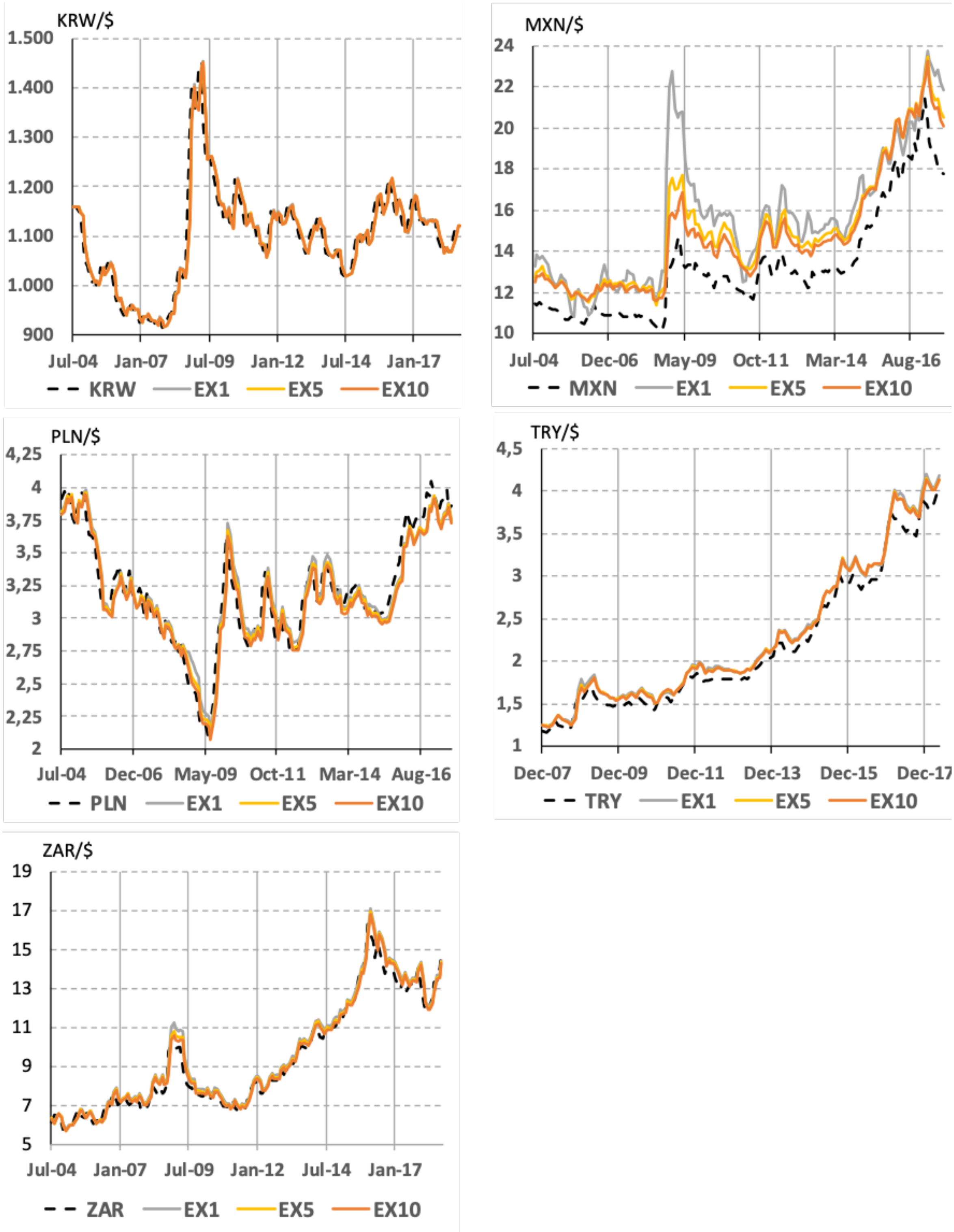

Figure 4.2: Observed and predicted exchange rates: South Korea, Mexico, Poland, Turkey and South Africa.

One of the main advantages of MAPE as a measure of forecast accuracy is that it can be implemented independently of the series' magnitude or unit of measurement. This tool has been used by many studies for comparing different methods and for forecasting accuracy as Makridakis et al. (1979), Karamouzis and Lombra (1989) or Deschamps and Mehta (1980), among others. Alternatively, we also use the SMAPE (symmetric mean absolute percentage error), another measure of forecast accuracy that in contrast to the MAPE has both an upper bound and a lower bound:[4]

$$SMAPE = 100 \sum_{t=T+1}^{T+k} \frac{|\widehat{y}_t - y_t|}{|\widehat{y}_t| + |y_t|} / k \tag{4.10}$$

Table 4.1 reports the forecast accuracy. For all currencies but the Chilean peso, the forecasts obtained from the random walk show lower predicting errors independently of the measure used. Regarding the forecast errors among the predictors obtained using inflation expectations, those calculated from the10-year horizon expectations perform better for most currencies, with the exception of the Chilean peso, the South Korean won, the Polish zloty and the Colombian peso. In the case of the Chilean peso, the lowest error is obtained using 1-year horizon inflation expectations, while for the Polish zloty the lowest error corresponds with 5-year inflation expectations. Regarding the South Korean won and the Colombian peso, the results depend on the error measure used.

Finally, we further compare the performance of the predictors with respect to a random walk using the test statistic proposed by Diebold and Mariano (1995) that analyses whether two competing forecasts have equal predictive accuracy. Let $\hat{y}_t^1$ and $\hat{y}_t^2$ denote alternative predictors of a given variable y_t, let e_{1t} and e_{2t} denote the corresponding prediction errors ($e_{1t} = \hat{y}_t^1 - y_t$ and $e_{2t} = \hat{y}_t^2 - y_t$, respectively), and let $d_t = (e_{1t})^2 - (e_{2t})^2$ denote the loss differential, then the Diebold and Mariano (DM) test involves a test of the hypothesis that the mean loss differential $\bar{d}$ is zero with an appropriate correction for serial correlation in the series d_t:

$$DM = \frac{\bar{d}}{s_d} \tag{4.11}$$

where $\bar{d}$ and s_d are the mean and sample standard deviation of dt. Following Harvey et al. (1997), we calculate the standard deviation using a small-sample bias corrected variance calculation. The test-statistic follows a Student's t-distribution

[4]For forecast which are too high there is not upper bound for the MAPE percentage error.

Table 4.1: Forecast accuracy.

Forecast	RMSE	MAPE	SMAPE	Theil U
Brazilian Real				
EX1	0.1511	4.8091	4.6701	0.0307
EX5	0.1406	4.4198	4.3098	0.0286
EX10	0.1359	4.3342	4.2334	0.0277
Random walk	0.0969	2.8364	4.8652	0.0201
Colombian Peso				
EX1	78.7756	2.4338	2.4444	0.0175
EX5	78.9238	2.4326	2.4444	0.0175
EX10	78.9677	2.4288	2.4415	0.0175
Random walk	78.7503	2.4111	2.4247	0.0174
Chilean Peso				
EX1	14.5580	1.9779	1.9806	0.0121
EX5	14.7907	2.0182	2.0222	0.0123
EX10	14.8460	2.0266	2.0313	1.0121
Random walk	14.7832	2.0017	2.0106	1.0120
Indian Rupee				
EX1	5.8080	10.6135	9.9418	0.0539
EX5	4.6980	9.1999	8.7592	0.0439
EX10	4.3328	8.2595	8.1557	0.0406
Random walk	0.8829	1.1989	1.2034	0.0086
Mexican Peso				
EX1	2.7246	17.6266	15.8083	0.0927
EX5	1.9033	13.6860	12.7408	0.0660
EX10	1.5886	11.5549	10.8885	0.0556
Random walk	0.3555	1.7433	1.7553	0.0138
Polish Zloty				
EX1	0.1301	3.3460	3.3307	0.0201
EX5	0.1224	3.0510	3.0681	0.0190
EX10	0.1268	3.0588	3.1012	0.0198
Random walk	0.1048	2.4360	2.4440	0.0154
South African Rand				
EX1	0.5083	4.1709	4.0561	0.0256
EX5	0.4411	3.5892	3.5201	0.0223
EX10	0.3985	3.2205	3.1825	0.0202
Random walk	0.3819	2.8880	2.9049	0.0199
South Korean Won				
EX1	28.5425	1.6457	1.6498	0.0130
EX5	28.7024	1.6441	1.6494	0.0130
EX10	28.7361	1.6415	1.6473	0.0131
Random walk	27.7056	1.6091	1.6132	0.0123
Turkish Lira				
EX1	0.1522	5.9853	5.7726	0.0319
EX5	0.1397	5.4824	5.3068	0.0294
EX10	0.1339	5.1885	5.0308	0.0282
Random walk	0.0744	2.4355	2.4689	0.0162

Note: EX1, EX5 and EX10 are exchange-rate forecasts based on EVRPPP [equation 4.5] using 1-year, 5-year and 10-year inflation expectations, respectively.

with $T-1$ degrees of freedom. Thus, a significant and positive (negative) value for DM indicates a significant difference between the prediction errors generated by the two predictors, indicating that the most accurate predictor is $\hat{y}_t^2(\hat{y}_t^1)$.

The results from the Diebold and Mariano test in Table 4.2 indicate that our predictors perform worse than a random walk with the exception of the Chilean peso. For this currency, the predictors obtained using inflation expectations perform better than the random walk. In the cases of the Colombian peso and the South Korean won, the difference between the two predictors is not significant. One possible explanation of these results is that inflation expectations are better suited for predicting the foreign exchange in countries where the risk premium with respect to US government debt is lower.

4.3.3 Directional forecast

As Boothe and Glassman (1987) observe, a further test of forecasting performance relative to the forecasts of a random walk is the accuracy in the direction of movements in the exchange rate of the emerging economies under study. This is because getting the right sign in the prediction matters in markets with low transaction costs, like foreign exchange markets. Therefore, we calculated the correct percentage appreciations and depreciations, the results of which are presented in Table 4.3. As can be seen there, with the exception of KRW, the forecasts based on EVRPPP offer a value that is greater than 50%, which indicates an improvement over the random walk in terms of directional prediction.

4.3.4 Causality

Engel and West (2005) argue that the use of Granger-causality tests can help to assess if fundamental variables such as relative inflation provide help in predicting changes in floating exchange rates. In this sense, one variable Granger-causes some other variable, given an information set, if past information about the former can improve the forecast of the latter based only in its own past information. Therefore, the knowledge of one series evolution reduces the forecast errors of the other, suggesting that the latter does not evolve independently of the former (Granger, 1969: and Sims, 1972). The resulting statistics are reported in Table 4.4, Table 4.5 and Table 4.6. As can be seen, with the exception of the Colombian and the Mexican peso when using EVRPP based on 10-year expected inflation differentials, our results suggest that Granger causality runs from exchange rate

Table 4.2: Diebold Mariano predictability tests

	EX1 vs. RW	**EX5 vs. RW**	**EX10 vs. RW**
BRL	3.4747	3.1663	3.1024
	(0.0007)	(0.0019)	(0.0024)
COB	-0.8042	-0.6014	-0.5904
	(0.4225)	(0.5485)	(0.5558)
CLP	-1.4375	-0.9052	-0.7475
	(0.0000)	(0.0000)	(0.0000)
INR	14.0730	22.2971	24.7583
	(0.0000)	(0.0000)	(0.0000)
MXN	7.8879	15.8472	17.7432
	(0.0000)	(0.0000)	(0.0000)
PLN	4.3322	4.0508	4.4554
	(0.0000)	(0.0000)	(0.0000)
ZAR	3.5999	2.4790	1.3809
	(0.0004)	(0.0142)	(0.1691)
KRW	-0.8556	-0.8719	-1.2025
	(0.3934)	(0.3845)	(0.2309)
TRY	5.9161	5.5095	5.1628
	(0.0000)	(0.0000)	(0.0000)

Note: BRL, COB, CLP, INR, MXN, PLN, ZAR, KRW and TRY stand for Brazilian Real, Colombian Peso, Chilean Peso, Indian Rupee, Mexican Peso, Poland Zloty, South African Rand, South Korean Won, and Turkish Lira respectively. EX1, EX5 and EX10 are exchange-rate forecasts based on EVRPPP [equation 4.5] using 1-year, 5-year and 10-year inflation expectations, respectively. RW stands for exchange-rate forecasts based on a random walk. p-values in parenthesis.

to the forecasts based on EVRPPP suggesting the former contains useful information for forecasting the latter that is not contained in its own past observations. Additionally, we find evidence of bidirectional Granger-causality in the cases of the KRW and the TRY for all EVRPPP forecasts and for the PLN when using the EVRPP based on 1-year expected inflation differentials. Finally, we find some weak evidence (at 10 percent) in favour of additional Granger causality running from EVRPP based on 5-year expected inflation differentials to exchange rates in the cases of COB, and PLN.

Table 4.3: Directional forecast

Forecast	EX1	EX5	EX10
BRL	66.00	67.60	69.20
COB	65.18	65.21	65.77
CLP	57.45	61.30	62.03
INR	57.93	62.42	61.15
MXN	55.41	59.95	58.41
PLN	59.87	61.15	60.51
ZAR	52.35	54.12	52.94
KRW	47.06	45.88	47.58
TRY	55.62	57.26	57.81

Note: BRL, COB, CLP, INR, MXN, PLN, ZAR, KRW and TRY stand for Brazilian Real, Colombian Peso, Chilean Peso, Indian Rupee, Mexican Peso, Poland Zloty, South African Rand, South Korean Won, and Turkish Lira respectively. EX1, EX5 and EX10 are exchange-rate forecasts based on EVRPPP [equation 4.5] using 1-year, 5-year and 10-year inflation expectations, respectively. Percentage of appreciations and depreciations correctly predicted by EVRPP.

Table 4.4: Granger causality test - F Statistic: Brasil, Colombia and Chile.

	Brazilian Real		
BRL $\rightarrow$ EX1	2730.13	EX1 $\rightarrow$BRL	1.6890
	(0.0000)		(0.1891)
BRL $\rightarrow$ EX5	7456.87	EX5 $\rightarrow$BRL	1.7169
	(0.0000)		(0.1840)
BRL $\rightarrow$ EX10	11405.70	EX10 $\rightarrow$BRL	1.8347
	(0.0000)		(0.1642)
	Colombian Peso		
COB $\rightarrow$ EX1	95.5770	EX1 $\rightarrow$COB	0.6766
	(0.0000)		(0.5129)
COB $\rightarrow$ EX5	785.4280	EX5 $\rightarrow$COB	2.4863
	(0.0000)		(0.0927)
COB $\rightarrow$ EX10	0.1041	EX10 $\rightarrow$COB	0.3898
	(0.9013)		(0.6791)
	Chilean Peso		
CLP $\rightarrow$ EX1	30197.80	EX1 $\rightarrow$CLP	1.1261
	(0.0000)		(0.3318)
CLP $\rightarrow$ EX5	240334	EX5 $\rightarrow$CLP	1.1671
	(0.0000)		(0.3198)
CLP $\rightarrow$ EX10	393347	EX10 $\rightarrow$CLP	0.6923
	(0.0000)		(0.5048)

Note: BRL, COB and CLP stand for Brazilian Real, Colombian Peso and Chilean Peso respectively. EX1, EX5 and EX10 are exchange-rate forecasts based on EVRPPP [equation 4.5] using 1-year, 5-year and 10-year inflation expectations, respectively. p-values in parenthesis.

Table 4.5: Granger causality test - F Statistic: India, Mexico and Poland.

	Indian Rupee		
INR $\rightarrow$ EX1	109.9530	EX1 $\rightarrow$INR	0.2263
	(0.0000)		(0.7977)
INR $\rightarrow$ EX5	762.0390	EX5 $\rightarrow$INR	0.7718
	(0.0000)		(0.4640)
INR $\rightarrow$ EX10	2020.42	EX10 $\rightarrow$INR	0.8338
	(0.0000)		(0.4364)
	Mexican Peso		
MXN $\rightarrow$ EX1	95.5770	EX1 $\rightarrow$ MXN	0.6766
	(0.0000)		(0.5129)
MXN $\rightarrow$ EX5	785.4280	EX5 $\rightarrow$MXN	2.4863
	(0.0000)		(0.0927)
MXN $\rightarrow$ EX10	0.1041	EX10 $\rightarrow$MXN	0.3898
	(0.9013)		(0.6791)
	Polish Zloty		
PLN $\rightarrow$ EX1	2016.74	EX1 $\rightarrow$ PLN	3.4102
	(0.0000)		(0.0356)
PLN $\rightarrow$ EX5	3772.34	EX5 $\rightarrow$PLN	2.8097
	(0.0000)		(0.0634)
PLN $\rightarrow$ EX10	4504.64	EX10 $\rightarrow$PLN	2.6545
	(0.0000)		(0.0739)

Note: INR, MXN and PLN stand for Indian Rupee, Mexican Peso and Poland Zloty, respectively. EX1, EX5 and EX10 are exchange-rate forecasts based on EVRPPP [equation 4.5] using 1-year, 5-year and 10-year inflation expectations, respectively. p-values in parenthesis.

Table 4.6: Granger causality test - F Statistic: South Africa, South Korea and Turkey.

	South African Rand		
ZAR → EX1	4215.09	EX1 →ZAR	1.3245
	(0.0000)		(0.2688)
ZAR → EX5	9620.60	EX5 →ZAR	1.2195
	(0.0000)		(0.2980)
ZAR → EX10	12989.90	EX10 →ZAR	1.1893
	(0.0000)		(0.3070)
	South Korean Won		
KRW → EX1	241523	EX1 → KRW	9.5748
	(0.0000)		(0.0001)
KRW → EX5	1327771	EX5 →KRW	8.8175
	(0.0000)		(0.0002)
KRW → EX10	2643987	EX10 →KRW	9.3024
	(0.0000)		(0.0001)
	Turkish Lira		
TRY → EX1	1769.57	EX1 → TRY	4.5090
	(0.0000)		(0.0130)
TRY → EX5	13563.50	EX5 →TRY	4.1244
	(0.0000)		(0.00186)
TRY → EX10	28724	EX10 →TRY	3.4656
	(0.0000)		(0.0345)

Note: ZAR, KRW and TRY stand for South African Rand, South Korean Won and Turkish Lira, respectively. EX1, EX5 and EX10 are exchange-rate forecasts based on EVRPPP [equation 4.5] using 1-year, 5-year and 10-year inflation expectations, respectively. p-values in parenthesis.

4.4 Expectation Formation

To assess if the expectations are rational one necessary requirement to be met is that of consistency. Consistency is weaker than rationality, since it is not required that the prediction process match the stochastic process generating the actual series. Following Froot and Ito (1989), consistency of expectations built at the same moment in time dominate if we obtain the same result when we compare the expectation about the inflation rate for the entire time period with the expectations about inflation rate changes during shorter time periods.

We assume the same model used by Frankel and Froot (1987a, b) and Frenkel et al. (2012) in which the agents build their expectations using an extrapolative model which can, in its simplest form, be expressed as a distributed lag function with one lag:

$$\pi_k^e - \pi_t = \alpha_k + \beta_k(\pi_{t-1} - \pi_t) + \zeta_t \tag{4.12}$$

where π_t and π_k^e denote, respectively, the inflation rate at time t and the expected inflation rate at time $t+k$ made at time t. Subscript k denotes the forecast horizon (1-, 5- and 10-years in our case) and ζ_t is the error term.

An estimated positive value for β_k would indicate that with a slowdown in price growth during the period preceding the time of the forecast leads market participants to expect an opposite effect for the next period. Therefore, they will expect that the inflation rate in period $t+k$ exceed that registered in t, expectations being in this case stabilising. On the contrary, if $\hat{\beta}_k$ is negative, and in the preceding period market participants observe a reduction in the rate at which prices growth then they expect that the inflation rate in period $t+k$ will be lower than that in t, expectations being in this case destabilising.

Note that our inflation expectations data gathers market participants' expectations at different horizons at the same point of time, the information set available to the agents being the same, therefore allowing us to formally estimate equation (4.12) for such forecasting horizons.Table 4.7 and Table 4.8 reports the results. As can be seen, are positive in all cases except for South Africa. Therefore, our indicate that the inflation expectations on Brazil, Colombia, Chile, India, Mexico, Poland, South Korea and Turkey are formed by market participants in a stabilising way, while in the case of South Africa there is evidence of destabilising expectations. Therefore, our results suggest that we should not reject the null hypothesis that 1-year, 5-year and 10-year inflation expectations are consistent.

Table 4.7: Expectation formation processes: Brazil, Colombia, Chile, India and Mexico.

Forecast	1-year ahead	5-year ahead	10-year ahead
		Brazil	
$\hat{\alpha}_k$	-0.1849	-0.1068	0.0794
	(0.0000)	(0.0832)	(0.3580)
$\hat{\beta}_k$	0.1435	0.4310	0.5649
	(0.0527)	(0.0238)	(0.0351)
		Colombia	
$\hat{\alpha}_k$	1.0906	0.6947	0.2690
	(0.0000)	(0.000)	(0.0000)
$\hat{\beta}_k$	0.5117	0.5104	0.5089
	(0.0000)	(0.0000)	(0.0000)
		Chile	
$\hat{\alpha}_k$	-0.0810	0.0412	0.1283
	(0.3181)	(0.0761)	(0.0396)
$\hat{\beta}_k$	0.1451	0.4768	0.5235
	(0.0044)	(0.0014)	(0.0013)
		India	
$\hat{\alpha}_k$	-0.2188	-0.0526	-0.0071
	(0.1715)	(0.7828)	(0.9725)
$\hat{\beta}_k$	0.7621	0.8940	0.5523
	(0.0001)	(0.0108)	(0.0258)
		Mexico	
$\hat{\alpha}_k$	3.6881	3.6896	3.6951
	(0.0000)	(0.0000)	(0.0000)
$\hat{\beta}_k$	0.5764	0.5240	5.5119
	(0.0001)	(0.0000)	(0.0000)

Note: p-values in parenthesis.

Table 4.8: Expectation formation processes: Poland, South Africa, South Korea and Turkey.

Forecast	1-year ahead	5-year ahead	10-year ahead
		Poland	
$\hat{\alpha}_k$	-0.0268	-0.3051	-0.7910
	(0.8006)	(0.0024)	(0.0000)
$\hat{\beta}_k$	1.8965	1.7017	1.6379
	(0.0000)	(0.0000)	(0.0000)
		South Africa	
$\hat{\alpha}_k$	0.0104	-0.5554	-1.1541
	(0.8813)	(0.0000)	(0.0000)
$\hat{\beta}_k$	-0.4967	-0.3941	-0.2855
	(0.0000)	(0.0041)	(0.0068)
		South Korea	
$\hat{\alpha}_k$	-0.0886	-0.1021	-0.1060
	(0.0162)	(0.0592)	(0.0794)
$\hat{\beta}_k$	-0.1409	0.3455	0.4050
	(0.0143)	(0.0154)	(0.0110)
		Turkey	
$\hat{\alpha}_k$	-0.2363	-0.1626	-0.1483
	(0.0045)	(0.2529)	(0.3351)
$\hat{\beta}_k$	0.2624	0.4549	0.4924
	(0.0051)	(0.0051)	(0.0051)

Note: p-values in parenthesis.

4.5 Robustness Checks

We have already documented running the Diabold and Mariano (1995) that inflation expectations cannot beat the random walk in predicting the foreign exchange for most of the currencies pairs analyzed. Sosvilla-Rivero and Garcia (2005) show on the contrary that for the euro area and the U.S. inflation expectations do behave significantly better than a random walk in predicting the foreign exchange.

One of the reasons why in this case the performance of inflation expectations is poorer, with some exceptions such as Chile, could be that the real rates of interest over the two countries are not equated as it is required by equation (4.4). This could be a plausible assumption for two developed economic areas such as the euro zone and the U.S. but it may fail to hold for emerging economies as the interest rates of these countries use to include a credit risk premium. In order to analyze this issue we have recover equation (4.3) as our main specification without imposing the equality in the real rates of the emerging economy and the U.S. That's it, we have simply used the uncovered interest rate parity condition to asses it usefulness in predicting the foreign exchange.

Table 4.9 show the results of the Diabold and Mariano (1995) test that compares the forecasting power of the difference between the nominal rates and a random walk in predicting the foreign exchange. The results show that for most cases the differential in the nominal interest rates cannot outperform the random walk. Only in predicting the Turkish lira and the South African Rand it is possible to outperform the random walk. These results point out that there are other factors apart from the credit risk premium that make inflation expectations not being able to outperform the random walk. It is reasonable to conclude that departures from the uncovered interest rate parity seem to be affecting the capacity of inflation expectations to forecast the foreign exchange.

Finally we have also asses the forecasting performance of the differential in the nominal interest rates in terms of the direction of movements in the exchange rate. We calculate the correct percentage of appreciations and depreciations. The results are slightly better than those obtained using only inflation expectations, outperforming the random walk in all cases. By these metrics, we conclude that there is some role played by the risk premium in augmenting the forecasting power of the directions of movements in the exchange rate for the currency pairs anlayzed. Table 4.10 show the results.

Table 4.9: Diebold Mariano predictability tests: EVRPPP augmented.

	EX1 vs. RW	EX5 vs. RW	EX10 vs. RW
BRL	1.0572	1.0642	1.0826
	(0.2933)	(0.2902)	(0.2820)
COB	3.4873	5.4683	6.5103
	(0.0006)	(0.0000)	(0.0000)
CLP	1.4980	1.4767	1.4692
	(0.1392)	(0.1450)	(0.1468)
INR	2.8867	2.8870	2.8872
	(0.0044)	(0.0044)	(0.0044)
MXN	10.3905	14.7877	13.1643
	(0.0000)	(0.0000)	(0.0000)
PLN	2.8464	2.8465	2.8464
	(0.0050)	(0.0050)	(0.0050)
ZAR		1.1572	-2.0583
		(0.2488)	(0.0416)
KRW	9.8000	3.9093	4.2310
	(0.0000)	(0.0001)	(0.0000)
TRY	-5.3948	-5.0149	0.1496
	(0.0000)	(0.0000)	(0.8814)

Note: BRL, COB, CLP, INR, MXN, PLN, ZAR, KRW and TRY stand for Brazilian Real, Colombian Peso, Chilean Peso, Indian Rupee, Mexican Peso, Poland Zloty, South African Rand, South Korean Won, and Turkish Lira respectively. EX1, EX5 and EX10 are exchange-rate forecasts based on risk-premium augmented EVRPPP [equation 4.3], using 1-year, 5-year and 10-year inflation expectations, respectively. RW stands for exchange-rate forecasts based on a random walk. p-values in parenthesis.

Table 4.10: Directional forecast: EVRPPP augmented.

Forecast	EX1	EX5	EX10
BRL	68.65	68.35	68.60
COB	65.24	65.30	65.35
CLP	60.82	63.17	65.92
INR	59.77	62.73	63.37
MXN	61.84	62.34	63.15
PLN	60.23	63.17	62.34
ZAR		55.94	56.17
KRW	51.17	53.47	51.49
TRY	58.06	58.24	59.19

Note: BRL, COB, CLP, INR, MXN, PLN, ZAR, KRW and TRY stand for Brazilian Real, Colombian Peso, Chilean Peso, Indian Rupee, Mexican Peso, Poland Zloty, South African Rand, South Korean Won, and Turkish Lira respectively. EX1, EX5 and EX10 are exchange-rate forecasts based on risk-premium augmented EVRPPP [equation 4.3], using 1-year, 5-year and 10-year inflation expectations, respectively. Percentage of appreciations and depreciations correctly predicted by risk-premium augmented EVRPP.

4.6 Conclusion

We have evaluated the empirical relevance of an expectations version of Purchasing Power Parity (PPP) for explaining the behaviour of the exchange rate in a sample of representative emerging economies. The PPP model used is based on the difference between equivalent inflation rates, an approximation to expected inflation in financial markets, for Brazil, Colombia, Chile, India, Mexico, Poland, South Africa, South Korea and Turkey with respect to the United States.

Using monthly data on exchange rates and on the inflation expectations, we have obtained the result that our predictors are not significantly better than the random walk model for forecasting based on 1-year, 5-year and 10-year inflation expectations. Nevertheless, with the exception of the South Korean Won, they outperform the random walk when considering the sign of the rate of change.

To further evaluate the role of fundamental variables as potential determinants of the short-run behaviour of exchange rates in emerging economies, we have also evaluate the Granger-causality between exchange rates and expected inflation differentials. Our results strongly support Granger causality running from exchange rate to the forecasts based on EVRPPP and only partial evidence of Granger causality running the other way around.

As for the consistency properties of the inflation expectation process, with the exception of South Africa, we find that market participants form stabilising expectations suggesting that 1-year, 5-year and 10-year inflation expectations are mutually consistent.

We have also examined if the uncovered interest rate parity condition could be useful in predicting the foreign exchange, obtaining results that it is possible to outperform the random walk prediction in the cases of the Turkish lira and the South African rand. Moreover, the directional forecasts based on the uncovered interest rate parity condition are better that those obtained only with inflation expectations, outperforming the random walk in all cases.

We consider that our findings may provide useful insight into the file of exchange rate forecasting that could be useful to portfolio managers, risk strategists and international traders.

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Chapter 5

Concluding Remarks

The dissertation has been structured around three essays mainly focusing on the nominal exchange rate regime and its consequences for the external adjustment process. With the topic having being debated as long ago as the days of the Bretton Woods system of fixed exchange rates, the policy analysis of this issue remains vivid as new currency unions emerge and large net liability positions amount. The chapters of this dissertation have covered different scenarios providing a complete framework for the analysis of the foreign exchange regime and its consequences on the external adjustment. I have analyzed the effects of moving from a fixed exchange rate regime to a floating one in the case of the U.S., and the opposite case, a change to a fixed exchange rate regime for the countries of the euro area. Moreover, having included creditor and debtor countries in the chapter that covers the European monetary union has provided a general view of the different consequences depending on the country characteristics.

In Chapters 2 and 3, I have documented the structural changes in the behavior of the net external positions that happened at the time of an exchange rate regime swift. For the case of the U.S., the results suggested that changing to a floating rate has increased the role played by the foreign exchange in the external adjustment process. Asset pricing implications showed how some of the deterioration of the U.S. external position could be expected to be corrected by the future depreciation of the dollar. On the contrary, for France, Italy and Spain, my findings indicated that the monetary union has diminished the role of the exchange rate as a mechanism to reduce external imbalances. The sovereign debt crisis of the euro zone that followed the global financial crisis represents a good example on how fixed exchange rates may complicate the reduction of external imbalances as the automatic mechanism of exchange rate depreciation is not in place. Several countries within the euro zone have relied on internal devaluation processes that reduced wages and consumer price levels to improve its external position and gain competitiveness in the absence of the automatic nominal devaluation mechanism provided by the foreign exchange. This processes may result in more painful and slower adjustments in a context of nominal rigidities. Because of that it is necessary for these countries to be aware of the need of structural reforms to make labor and product markets more flexible to absorb adverse shocks and, in general, to make the economy more competitive. From this point of view, having a fixed exchange rate regime should be an incentive to implement long-term policies and structural reforms to reduce the negative consequences of economic and financial crisis. It is also relevant to keep in mind that countries within the same monetary union may hold creditor or debtor positions, being the policy actions needed to facilitate the external adjustment different in each case.

In Capters 2 and 3 there are also important lessons for emerging market economies, especially regarding the importance of valuation effects on the external adjustment process. We have learnt from this dissertation that Germany have experienced adverse valuation effects that have increased its external imbalance. The case of Germany is not worrisome as it holds a creditor position and the valuation effects were related to expected future positive return differentials between its foreign assets and liabilities. For emerging markets economies adverse valuation effects could be dangerous for countries with large net liabilities positions. As emerging countries usually hold a large part of its external liabilities denominated in foreign currencies, a depreciation of the local currency implies and automatic deterioration of its external imbalance. These effects could be especially harmful during periods of financial stress or during balance-of-payments crisis.

The process of external adjustment in emerging market economies and the selection of the foreign exchange regime for these economies should be a topic of further research to complement the findings of this dissertation. At the same time, analyzing the welfare effects related to the change in the external adjustment for countries joining a currency union is another issue that deserves further research.

Finally, the findings from Chapter 4 showed how inflation expectations are relevant in forecasting the foreign exchange for a set of emerging market economies, and outperform the random walk when considering the sign of the rate of change. Further analysis that takes into account the factors behind possible deviations from the uncovered interest rate parity may result in better predictors of the foreign exchange.

In view of the mildly encouraging results of the three chapters of this thesis, some optimism about the benefits from implementing these extensions seems justified.